THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

VOL. V. Nº 108—7th YEAR.] LONDON, DECEMBER 9, 1856. [Subscription per Ann. { 15s. in Advance / 18s. Credit } Price 8d. Unstamped.

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AND

COMPENSATING GAS METERS,

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WANTED, by the Londonderry GASLIGHT COMPANY, a Person qualified to act as METER INSPECTOR and SUPERINTENDENT of STREET MAINS. He must be versed in the Construction and Repairing of Gas-meters, and will be required to do General Repairs in the Works. Salary, £70 per annum. Applications (in applicant's handwriting), accompanied with copies of Testimonials of character and efficiency, to be addressed to Mr. HENRY RIDLEY, Manager, Gas-works, LONDONDERRY, on or before the 9th of December next.

Londonderry Gas-works, Nov. 12, 1856.

OXIDE OF IRON PURIFICATION.

MR. RICHARD LAMING has at last publicly acknowledged that he has no right to grant Licences. We beg that all parties interested will note this fact.

Our object throughout has simply been to maintain our only just rights, purchased for valuable consideration, and to warn the Public against Mr. Laming's specious and delusive offers; and we have referred to agreements only to bear out our assertion, that he had ceded to us all his rights of every kind to the Purification of Gas by means of any Oxides of Iron.

Gas Companies will scarcely wish to become arbitrators of Mr. Laming's imaginary private wrongs, as to listen to *ex parte* statements from either side. We, therefore, feel that the only notice we are called upon to take, of his repeated references to an alleged refusal on our parts to submit questions to arbitration, is, that his assertions are indelicate and unwarrantable, as we shall be prepared to prove at the proper time and place.

We confirm the position we have all along maintained, that any Invention of Mr. Laming's for the Purification of Gas by means of Oxides of Iron belongs to us, whether "*efficacious*" or useless; and that we still stand engaged to reward any one who will furnish us with legal proof of the use of any such Oxides by him, or by any parties under license from, or agreement with, him.

A word in conclusion. Mr. Laming states in his last advertisement, which has called forth this notice from us, that his "*Free*" Revivifiable Oxide is to be obtained *on very inexpensive conditions;* the nature, therefore, of the boon he proposes to lay at the feet of the Public would appear to rather peculiar; indeed, it seems as if a *quid pro quo* is expected for the *Gift*. Perhaps Mr. Laming will explain.

OWEN AND MERTENS.

Chemical Works, Mill Wall,
October 24, 1856.

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Price, free on board, or delivered at the railway stations, may be learned by addressing James Ferguson and Co., Gas-Coal Works, Lesmahago; or J. H. Jones, 1, Poets'-corner, Westminster, sole Agent for London.

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GAS-METER MANUFACTURERS,
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beg to submit to Gas Companies and others some of the advantages possessed by their
PATENT ANTI-CORROSIVE ECCENTRIC GAS METER
over those of the ordinary kind.
The Case is formed of strong Sheet Iron of the best quality by powerful machinery; and, when complete, consists of
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(the ordinary case contains Twenty-five pieces), which is thickly coated, with a Metallic Alloy, similar to that of the Drum, which renders it as durable as the Drum itself.
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The parts that communicate Motion to the Index are INDESTRUCTIBLE, and will continue in good working order for an indefinite period.
The FLOAT is cylindrical, and not liable to collapse.
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The INDEX is thoroughly protected from water rising in the Spindle Tube, should the pressure exceed six inches.
The FILLING and WATER-LEVEL APPARATUS are on the Syphon principle, which prevents the abstraction of Water from the Meter by pressure.
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AND
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Beg to inform Gas and Water Companies and the public, that they keep in stock in London all the CASTINGS in general use in Gas and Water Works, including best cold-blast Iron Retorts, Socket and Flange Pipes of all sizes, Bends, Branches, Syphons, Lamp Columns of various patterns, &c.
N.B.—Orders for Cast-iron Tanks, Girders, Columns, Cylinders, and all irregular castings, will have immediate attention.
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BRYAN DONKIN and CO.'s improved GAS VALVES have been adopted by numerous Gas Companies in England and abroad, and their advantages and great security fully proved. Very large numbers are in use. Prices from 11s. to 14s. per inch diameter.
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Engineers, near Grange-road, BERMONDSEY.

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These RETORTS are generally used in the Gas-works of Preston, Accrington, Bury, Heywood, Middleton, Rochdale, Ratcliffe; the Mills of Messrs. Horrocks, Miller, and Co., Preston, &c. &c., and are unequalled in having afforded general satisfaction to those who have given these Retorts a trial.
To meet the increasing demand, the Works at Little Harwood have been greatly enlarged; and Gas Engineers who may favour with an Order may rely with confidence on their being promptly supplied with an article not to be surpassed in finish or durability.
PRICES MODERATE.

LIVESEY FIRE-CLAY WORKS,
NEAR BLACKBURN, LANCASHIRE.
O. BROTHERS AND COMPANY,
MANUFACTURERS OF PATENT CARBONACEOUS CLAY RETORTS,
AND EVERY DESCRIPTION OF
TUBULAR GLAZED SEWERAGE PIPES, BENDS, JUNCTIONS, ETC.
FIRE-BRICKS, TILES, BLOCKS, AND CHIMNEY-TOPS.

ESTABLISHED in 1795.

JOSEPH CLIFF,
WORTLEY FIRE-BRICK WORKS, near LEEDS.
FIRE-CLAY RETORTS, OF ANY SIZE OR SHAPE, SUPPLIED ON SHORTEST NOTICE.
These Retorts are used extensively in the Gas Works of Leeds, Hull, Liverpool, Preston, Bradford, Rochdale, and other towns, where they have been tested side by side with those of Stourbridge, Newcastle, and other makes, and have invariably proved themselves a superior article.
Eminent Gas Engineers bear testimony that these Retorts are the BEST FINISHED AND MOST CORRECT IN FORM of any in the kingdom. Their surfaces are, by the peculiar method of their manufacture, unusually smooth, close, and FREE FROM SURFACE CRACKS; thus, in a great measure, preventing leakage and the adhesion of carbon to their interior surfaces.
To meet the great increase in demand, extensive enlargement of premises and the fitting up of more perfect apparatus have been effected; and gas engineers may rely with confidence on their orders, to any extent, being promptly and satisfactorily executed.
N.B.—FIRE BRICKS, TILES, AND OTHER FIRE GOODS OF UNEQUALLED QUALITY.—EXPORT ORDERS PROMPTLY EXECUTED.
M. B. NEWTON, London Agent, No. 4, Wharf, King's Cross Goods' Station.

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TO CORRESPONDENTS.

G. H., Deal.—*Your suggestion is an excellent one, and we will endeavour to carry it out.*

A Subscriber, Dudley.—*The returns made by gas companies, in compliance with Mr. Brotherton's motion, will be presented to the House of Commons early in the next session, and will, no doubt, be printed. There is no legal obligation to make the return, nor any penalty in the event of an incorrect one being made.*

A Subscriber, Holt.—*The price currents are corrected by eminent houses in each trade, who will supply the articles at the prices fixed.*

R. Laming's *communication will not be overlooked when a suitable opportunity presents itself of adverting to the subject again.*

G. Anderson's *communication is a proper subject for an advertisement.*

H. de Charente's *suggestion is valuable where the collection is made monthly, but is not applicable to the English system of collecting gas accounts.*

NOTICES.

The next number will be published on Tuesday, Dec. 23, and the subsequent numbers on each successive alternate Tuesday, till our project of weekly publication is carried into effect.

Stamped copies, when forwarded by post, must be folded so as to expose the stamp; they are otherwise liable to the full postage charge for letters.

This JOURNAL has been duly registered at the General Post Office for transmission abroad.

All Communications to be addressed to the Editor, No. 3, Parliament Street, Westminster; and orders for Advertisements to Mr. W. B. King, the Publisher, No. 11, Bolt Court, Fleet Street.

ERRATA.

SIR,—Will you permit me to ask your printer upon what principle he ventures to alter the reading of scientific papers entrusted to him for insertion in the JOURNAL OF GAS LIGHTING?

Dr. Griffin lately alluded to something which he called "camelion" (*sic in orig.*), but which your printer was pleased to alter into chameleon, though, for aught he knew to the contrary, the Dr. may mean "chamomile."

Again, in a passage where I stated that Dr. Griffin had "belied" the directors of the Bristol Gas Company, the same influence has put the word "believed," which was as far from my thoughts as it would now be for me to say that the directors in question "believed" Dr. Griffin's dubious analysis.

The occurrence of such perversions from the classic press of Mr. Catnach, in the Seven Dials, would be barely "tolerable," but from the Johnsonian region of Bolt Court, they are "not to be endured."

Dec. 8, 1856. LEWIS THOMPSON.

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, DECEMBER 9, 1856.

NOTES UPON PASSING EVENTS.

THE Metropolitan Board of Works and "Big Ben" appear to have adopted the course which prevails amongst our public men, and to have compromised the matter in discussion between them, by agreeing to the change suggested by Captain Burstall in the position of the outfall for the main sewers. Perhaps this is a politic proceeding; and, at any rate, it puts an end, for the present, to a very unseemly dispute between the representatives of the ratepayers of the Metropolis and one of the superior servants of the Crown; but it settles no principle, and leaves the door open to any future exhibition of upstart insolence, or of official incompetence, such as we have been compelled of late to witness. On this ground, the compromise must be a matter of regret; and it is sadly to be feared that a precedent has been thus established which will hereafter materially injure the moral weight and influence of the Board. The First Commissioner has, in fact, succeeded, firstly, in establishing his pretension that the proceedings of the Metropolitan Board are to be subject to his approval, instead of to the approval of *all* the Commissioners of Works and Buildings; and, secondly, he has proved that, upon the most contemptible and insufficient evidence, he is prepared to exercise his power. The Board, on the contrary, seem disposed, if they can only secure the virtual execution of their scheme, to waive the discussion of the principle which was really involved, namely, that of their independence. This they have carefully veiled over; but, at some future occasion, it must force itself upon the public; and, for our own part, we question the policy of avoiding at this moment the struggle which, sooner or later, must take place, because the grounds upon which "Big Ben" has chosen to defend his interference are so manifestly absurd, that he had given his adversaries all the chances of the game. To make the Metropolitan Board alter a maturely prepared plan in the ridiculously minute manner suggested by Captain Burstall, was the mere wantonness of red-tape despotism: it was a change forced upon the Board for the mere sake of forcing a change: for no man in his senses will believe that the removal of the outfall of the sewers 1½ mile further from the metropolitan boundary, will ever affect the health of the Metropolis, for good or for evil. However, the compromise is made, and no principle, scientific, legal, or administrative, has been settled. We have now to see whether the Evangelical Alliance, which is rich enough to give dinners to newspaper editors, will get up a fresh excitement in order to defend the nose, and the property, of its redoubted champion.

The usual autumnal excitement on the subject of forming new parks has taken its ordinary course, and has again given rise to some rather sharp discussion. In the main, we believe that Mr. H. L. Taylor is right in his position, that they who would almost exclusively benefit by such operations should pay their cost; and, moreover, we are convinced that the tendency of the age to cast upon society in general the task of supplying private wants, is one which will be ultimately found to be fraught with extreme danger. The creation of parks, the establishment of baths and washhouses, the building of model lodgings, the gratuitous (or even the unremunerating) distribution of water, or other such charitable undertakings, when executed by means of compulsory rating over large areas not directly interested, are likely, we fear, to lose their amiable character, and to become means of depraving the moral sense of those whom it is most desired to benefit. Alas! it is but too true that hundreds and thousands of the poor children of this huge metropolis have nowhere to breathe the pure air of heaven; and the fearful rate of infantine mortality in London proves that this portion of our population, at least, has not its fair chance of living. But, then, it may fairly be questioned whether the habits, the past lives, and the examples of their parents, have not even more to do with this waste of life than even the privation of the means of healthy exercise; and, after all, the duty of providing proper places of recreation is incumbent on the proprietors of the land, who benefit by the agglomeration of the population, rather than upon the casual householder. It was the duty of such members of our hereditary branch of the Legislature, especially, as possess large estates in the thickly inhabited parts of London, to have provided for this social want, whilst they were parcelling out their land into streets and squares; or, if it be admitted that the town has grown so rapidly that all ordinary previsions have been upset, it must still be incumbent upon the proprietor of the soil to guard against the contingent evils of a movement from which he benefits so much. The Duke of Bedford has recently set a good example, by a liberal contribution towards the cost of the new street near St. Martin's Lane; and his universally admitted character, as a conscientious landowner, induces us to hope that his efforts to improve the sanitary condition of his property near Covent Garden will not stop here. A park at Finsbury, or at Hampstead, or at Bermondsey, will do little for the benefit of the population of the narrow and foul streets around Covent

Garden, Newport Market, and Clare Market; yet the rate-payers of these districts will have to contribute their quota to any general rate, whilst the landowners who actually profit by the existence of the present fearful state of things will escape from their fair share of the burthen. The fact is, we believe that the recent excitement upon the subject of the formation of places of public recreation is founded upon a mistaken view both of the proper positions in which they should be placed, and of the proper parties to pay for them.

In the meantime, why does not the Corporation of London do something to improve the site of Smithfield? There are portions of that area which might be rendered serviceable to the dense population around it, if the ugly pens were removed, and the surface asphalted; and this, too, might be done without interfering with the existing hay and straw market. The Corporation also require to be reminded that the Skin Market at Leadenhall is a serious nuisance, and that its retention in that precise locality is also a heavy burthen upon the various tradesmen who frequent it.

The applications to Parliament for the purposes connected with municipal and sanitary improvement, of which notices have been lodged, are this year very few in number, and of very small importance, so far as the character of the works is concerned. Application will be made for powers to form a new park for Finsbury; for a Thames embankment and railway; for the continuation of the outfalls of the London drainage upon Mr. M'Lean's plan; for the new streets in Southwark and near St. Martin's Lane; and for the alteration of the Charing Cross Bridge; so that the Metropolis, at least, bids fair to suffer many changes. Elsewhere, however, the activity is not so great; and we firmly believe that the continual tampering of recent Governments with the security of investments, in undertakings destined to supply public wants by the intervention of private enterprises, has annihilated for a time the spirit which formerly was so efficacious for our improvement. English capitalists have, indeed, been driven from the field of gas and water operations by the injustice of the attacks to which that description of property has lately been exposed; and they have been equally driven to risk their money in foreign railways or other works which promise better interest than the debentures of local boards, and are more secure than the property our fashionable Socialists delight in holding up to obloquy. The feeling of suspicion which attaches itself to all operations conducted under the recent laws of partnership with limited liability, must also be considered to have exercised a depressing influence upon the industry and enterprise of the country. When will the trading interests combine to make themselves heard by the Government? The Legislature only requires that the truth should be pointed out; but the parties most vitally interested seem to think that a retrospective grumble is all that is in their power, and they allow a set of active, mischievous, empirics to repeat, without contradiction, their fallacious statements, so that at last both the Legislature and the public are led to believe them. The history of that most useless, and now contemptible, body, the General Board of Health, is a practical illustration of the mischief which may be effected by the mere repetition of official nonsense; the great stagnation of gas and water operations is a sad commentary upon the effects of meddling legislation.

What will be the ultimate result to the public of the various amalgamations going on between the old and the consumers' gas companies, which seem now to be so much in fashion? On the Surrey side of London, one of the first measures adopted was to raise the price; and this we are convinced must also, sooner or later, ensue with the City and Central United Gas Companies. We have always, indeed, contended that the pretence of "cheap gas" under which the Central Company was started was a delusion, and are not, therefore, surprised that it should come to an untimely end; but the present proceedings of the directors of the Central Company on this subject do not appear to us to be very straightforward, and we are prepared for some extraordinary measure at a future period. In the meanwhile, the gas consumers may be certain that "gas at 4s. per 100 feet" is rapidly approaching the limbo which has already received the "water supply at 1½d. per tenement per week," or the "sewerage at 1d. per tenement per week," or the other bubbles blown by official empirics for the amusement of the public and their own benefit. The moral of all these tales is, indeed, that some arch agitator secures for himself a good place or a good bribe.

If new works are, for the present, suspended, many of those lately undertaken for the water-supply of our large towns, have, however, been urged forward with much energy. Amongst the most important of these are, unquestionably, the Rivington Pike works, for the town of Liverpool, and the Loch Katrine aqueduct, for Glasgow. These respective works are of a colossal magnitude, and they involve so many questions connected with the higher branches of hydraulic engineering, that we shall deem it to be our duty personally to visit and inspect them at the earliest opportunity. For the present, it may suffice to say, that the Rivington Pike system has rendered necessary the formation of artificial lakes of a collective area of about 600 acres, and a total capacity of nearly 3156 million gallons; and it may convey some idea of the magnitude of these operations to state, that the area of the lake of Geneva itself is only 240 times greater than that of the artificial storeage reservoirs thus formed; whilst the area of Lock Katrine, on which a steamer plies, is not more than 2500 acres, or about four times their superficial contents. The pipes for the distribution of the Rivington Pike water are now laid to the gates of Liverpool; and there is now no reason to question but that the distribution will soon take place in the town. In the case of the Glasgow works, we also observe that great progress has been made. Leeds, Weymouth, Coventry, and several other towns, have lately executed considerable improvements in their water supply, which we will notice with more detail, so soon as we can procure official information of their nature. But we may mention at present that the small works for the town of Weymouth are particularly interesting, on account of their containing the first application of the turbine water-wheel for such a purpose of which we have yet heard in our country. The district around Weymouth is also worthy of notice, on account of the copious springs it furnishes, and of the geological phenomena it presents. Perhaps the opening of the railway communication to Frome may again call attention to this delightful watering-place, which has latterly been abandoned by our pleasure-seekers, and even by our business population. It may possibly happen that the extension of the Government establishments in this neighbourhood may call attention to the outlying deposits of the Portland oolite on the mainland at Upway and Chilmark, and after the miserable failure of the magnesian limestone selected for the Houses of Parliament, some such "consummation were devoutly to be wished." The Institute of British Architects has turned its attention to this subject of building stones; but, unfortunately, practical questions are so little studied by that body, that little good is to be expected from their deliberations. By the way, the Admiralty have given notice that they intend to take into their own hands the springs of the island of Portland, and to appropriate them to the purposes of the Harbour of Refuge.

We have heard a rumour that the General Board of Health is shortly to be abolished, and its business transferred to the Secretary of State for the Home Department's Office. Of course we do not guarantee the correctness of the report, but really the shameful failures of this most incompetent branch of the Administration, and the incalculable mischief it has inflicted, would induce us to believe that a man of Sir G. Grey's superior abilities would be likely to put a stop to a state of things such as to reflect disgrace upon every administration with which it is connected. But what substitute is to be found for the Public Health Act, 1848? The whole of this vital question must come before the Legislature next year, and we warn all parties interested in its solution to prepare beforehand for the inquiry. Hitherto no fair investigation of the state of the law on sanitary subjects has taken place. Now it should be the earnest effort of those who are actually interested, to lay the whole truth before the Legislature and the public, who have alike been so long deceived by a set of specious but unscrupulous quacks.

Circular to Gas Companies.

THE trial of Hills *versus* the London Gas Company, for an alleged infringement of patent right in the use of oxide of iron for the purification of gas, has resulted in a "non-suit," under circumstances which clearly indicate that no patent right can, or does, exist for the employment of this oxide in the manufacture of gas. As it is not, however, our province to enter into a discussion of the legal arguments adduced on the above occasion, we content ourselves by calling attention

to the facts brought forward in the evidence, which we publish in its proper place in our columns, and which, as will be seen, most singularly confirms the conclusions arrived at and published in this JOURNAL more than three years ago. Those conclusions, it will perhaps be remembered, ascribed to Mr. Croll the merit of having first suggested the use of oxide of iron in the purification of gas; whilst to Mr. F. J. Evans they awarded the remarkable discovery of what is now called "revivification," or the process by which the oxide of iron can be used over and over again a great many times in succession, and to which alone we are indebted for the practical application of a system evidently destined to revolutionise the purification, not only of gas, but also of sewerage airs and waters, and many other sulphuretted combinations.

By a reference to the evidence, it will be found that, so far back as the year 1840, Mr Croll used the hydrated oxide of iron for the purification of a large portion of the gas manufactured at the Brick Lane station of the Chartered Gas Company; and we can now understand how it happened that Mr. Croll did not discover the revivifying process, as he appears to have carried the spent material to the upper part of the retort-beds, to be reconverted in a situation where the absence of light necessarily prevented him from observing the real nature of the action which ensued; otherwise, as this is directly the reverse of that produced by heat, it could scarcely have failed to arrest his attention. Thus, the heat acting at the lowest part of the black mass of sulphuret of iron, ought to have made this red before the upper part; but the actual result, on the contrary, is, that the upper part becomes red first, because this is the portion most exposed to the air, although, in Mr. Croll's case, the least exposed to the fire: we see, therefore, that had the attempt to reconvert the oxide by fire been made in open daylight, it would most likely have come within the observation of the first inventor, that simple exposure to air alone was the only requisite. As matters now stand, the entire merit of revivification rests with Mr. Evans; and whether it be regarded in the light of a mere accident, or as the result of acute perception, conjoined to careful reasoning, is equally deserving the gratitude of the gas world. By its means, much of the absurd clamour about unwholesome gas and gas-works loses its force, as there is no smell for the nosey-nuisance hunters to sniff at; and, although the oxide of iron process unquestionably entails an additional outlay upon the manufacture of gas, yet this is but a small thing compared with the comfort of being freed from Lord Palmerston's *nose*ological blood-hounds.

It appears to us, however, that no trifling thanks are due to the London Gas Company for thus coming forward to defend a common right against pretensions which are proved to have been unfounded; and we cannot too highly commend the manner in which their part of the case was arranged, or, as the technical phrase is, was "got up," by Messrs Rogers, the respectable solicitors employed on the occasion: carefully, judiciously, and full the arguments and evidence followed each other at the trial, with accumulated force; and, long ere the interposition of the learned judge, the jury had evidently heard enough to convince them that at the date of Mr. Hill's patent neither the purification of gas by any kind of oxide of iron, nor the revivification of that oxide by contact with the air, was a novelty within the reach of the great seal, however cunningly applied, or pertinaciously defended, after its application.

We congratulate the public at large upon the issue of this contest.

Our readers will perceive with regret that a paltry misunderstanding, the origin of which may be traced to the recriminations consequent upon the accidental mutual tapping of each other's mains by careless workmen, threatens to involve the Imperial and the London Companies in an expensive and suicidical contest, by which the interests of both bodies cannot fail to be prejudiced, without any prospect of compensating benefit. The London Company, driven to desperation by the pressure brought upon it to compel its withdrawal from a portion of the extensive parish of St. Pancras, has undertaken to carry its mains over the rest of the parish, and to supply the public lights at 1s. 6d. per lamp less than the price tendered by the Imperial Company upon a three-years' contract. We have hitherto held ourselves aloof from all participation in the disputes between these companies, but they have now reached a point beyond which the interests of the shareholders imperatively require they should not be carried, and the public are no less interested in the prevention of the expenditure of capital in works which may ultimately prove unproductive. If a warfare such as is threatened be actually commenced, the only limit to its duration will be the exhaustion consequent upon its prosecution; and, though the Imperial Company is assailable in other districts where it has now the exclusive supply of gas, if the shareholders of the London Company will supply the funds, yet there is no doubt of the desire and interest of both bodies to conclude a lasting and honourable peace; and we shall be gratified if, by their own good sense, or the interference of mutual friends, such a consummation is the sequel of the present hostile attitude.

The shareholders of the Great Central Company are convoked for the 19th inst., to consider the proposed terms of amalgamation with the City of London Company. We are unwilling to give publicity to the rumours current on the subject, which are, we regret to say, unfavourable to the success of any attempt to obtain a remunerating advance in the price of gas; and we propose, therefore, to await the official declarations, rather than trust to unauthenticated rumours, before further commenting on the subject.

A system which cannot be too strongly repudiated has latterly been adopted by some meter manufacturers, of employing persons of unenviable notoriety, and whose impudence is their principal qualification, to deliver public lectures in praise of their employers' wares, and to decry those of other manufacturers. It is much to be regretted that any respectable person should, even inadvertantly, pursue so disreputable a method of forcing a trade, as it must ultimately have the contrary effect, by inducing gas companies to combine in self-defence, and cease to deal with every one who resorts to such a system, either directly or indirectly.

Correspondence.

ON THE EFFECT OF COAL SMOKE AND OF GAS UPON BOOKBINDING.

SIR,—Your readers may recollect that some years since Dr. Faraday stated his belief that the binding of the books in the library of the Royal Institution was materially affected by the impurity of the gas there consumed; and in the celebrated oil-of-vitriol discussion, this opinion was often referred to. Alas! "there is nothing new under the sun"—not even false philosophy; and, as an illustration of the truth of this aphorism, I beg to present to your readers a translation of a passage from a book published in French, without the author's name, at Lausanne, in 1770, 3 vols. 12mo.

After a long tirade upon the effects of the coal-smoke of ancient London upon the public buildings, and some supposed illustrations of its ravages (which extend from page 76 to page 80 of the 1st vol.), the author proceeds to say (page 80):—

Libraries especially suffer from the ravages of the smoke. The most carefully executed bindings, preserved with the greatest care, and the most brilliant, rapidly assume the appearance of the books which in Paris have been exposed for two or three years, on the Quai de la Ferraille, to all the inclemencies of the atmosphere. It thence happens that students who are fond of fine bindings are obliged to shut up their books in air-tight cases: even then they are compelled to clean them from time to time; and Dr. Galli invariably commenced by this operation when we had occasion to consult any book out of his collection.

To my mind, this distinctly worded accusation against the coal-smoke, previously to 1770, shows that gas, subsequently to 1840, cannot be held responsible for the same damage. Perhaps both the assumed causes of the destruction of books may be innocent of the offence; for, in my own library, I possess a volume with the autograph of Lord Burlington, which must have been bound in 1746; and, although no especial care has been taken of it, and it has been exposed to both coal-smoke and to gas, it is still perfectly sound. Of course, I have other and older books; but I mention this one, because its binding bears a date which can be identified.

I remain, &c.,

A CIVIL ENGINEER.

M. JEANNENEY'S PHOTOMETRICAL EXPERIMENTS.

SIR,—I have read with interest M. Jeanneney's experiments, contained in your valuable Journal of the 2nd of September last, and also Mr. Lewis Thompson's remarks on the same.

M. Jeanneney told us that he made his experiments with the same *description* of burners, but with different-sized apertures—that is, consuming a different quantity with a given pressure. Mr. Lewis Thompson, in his letter of the 23rd ult., appears to understand that one particular burner was used, which, if it had been the case, would naturally, with a different pressure, have given a different consumption.

From what I understand, M. Jeanneney merely wishes to prove that, if you take two burners of the same description, but varying in the sizes of the aperture, the one consuming 3 feet per hour and the other 5 feet, with the same pressure—say 8-10ths of an inch—and reduce the pressure on the 5-feet burner, so as to make it con-

same only 3 feet, you will have a greater power of light than with the 3 feet at the 8-10th pressure. There is no doubt but this is the case; and the reason, as Mr. Thompson tells us, is, that the 5-feet burner would then be nearer the smoking-points than the 3-feet. I think, if Mr. Thompson had never taken notice of pressure in his experiments, he would not have found out the use of the governor. This instrument is absolutely necessary, without you are working from an experimental gasholder, when you can keep a given pressure. There is no doubt that gas should be burned at a reasonable pressure, and the burners made to suit the gas and pressure; for without this precaution, there is great waste of gas and light.

Paris, Nov. 23, 1856. T. SCHOLEFIELD.

Register of New Patents.

1026.—WRIGHT JONES, of Pendleton, in the co. of Lancaster, engineer, for "*Improvements for regulating the pressure and flow of steam, water, and other fluids.*" Patent dated April 30, 1856.

The object of this invention is to regulate the pressure and flow of steam, water, and other fluids within boilers, pipes, or other chambers—the apparatus also acting as a safety-valve, or for obtaining a desired amount of pressure or of heat, in the case of steam.

For this purpose, the supply acting on a column of mercury or other fluid is caused to open and close a valve. A vessel is provided with two pipes, the former leading from a steam-boiler, and the latter to pipes or other apparatus, within which a certain pressure of steam is required. The first pipe opens into a chamber furnished with seats for "a double" seat-valve, the former of which has a slotted pin for the reception of a lever jointed at one end to a bracket, and at the other, connected to a weight acting as a float within a vessel of mercury, which mercury proceeds from a column contained within a pipe. The action of the apparatus is as follows:—Suppose the desired amount of pressure to be within the second pipe, and consequently within any others connected therewith, the valves being kept closed by the weight, should the desired pressurs decrease, the mercury within the chamber will rise (supplied by the column), and the weight or float will be lifted, thereby turning the lever upon its centre, and raising the valves from their seats, through which steam from the boiler will be free to pass; and this will continue until a sufficient quantity shall have entered to restore the deficient pressure by the time the mercury will have been forced back into the column, and the valves will be closed by the sinking of the weight or float.

By altering the column of mercury, the pressure within the second pipe may be varied at pleasure, and by graduating the tube a gauge is obtained for indicating the said pressure. Although the apparatus has been alluded to as applied to steam, it will be obvious that it may be used after the same manner for regulating the supply of water or other fluids. Allusion has also been made to pressure as being the object in view, but it evidently follows that for heating purposes it is equally applicable, as a given amount of pressure will afford a constant amount of heat.

In order to adopt the above arrangement as a safety-valve, it will merely be necessary to reverse the action—that is, to connect the second pipe to the pressure, and the first pipe to the atmosphere, the valves being also reversed, so as to open downwards instead of upwards.

The claim is for—

1. The employment of a column of mercury or other fluid as a medium for opening and closing a valve, and so as to regulate the pressure and flow of steam, water, and other fluids.

2. The employment of a column of mercury applied, as before described, to a safety-valve.

1072.—RALPH HEATON, the younger, HARRY HEATON, and GEO. HEATON, of Birmingham, manufacturers, for "*A new and improved manufacture of balance-weights used for counterbalancing pendant lamps and chandeliers, and for other purposes.*" Patent dated May 7, 1856.

Balance-weights are ordinarily manufactured of stamped sheet brass, of any desired ornamental form, and filled with lead for the purpose of making them sufficiently heavy.

By the above patent process, they are made of cast iron, and afterwards plated or coated with brass, silver, or other metal or alloy, by means of the well-known process of electro-metallurgy, or by any other method whereby such coating can be effected.

The said balance-weights are cast solid, or nearly solid, so that they do not require to be weighted with lead, or only with a small portion of lead or other metal; and the casting may be effected either in sand, metal, or other moulds.

The essence of the invention consists in manufacturing balance-weights by the combination of the processes of casting in iron, and depositing or precipitating other metal or alloy upon the cast iron. It is applicable to the manufacture of balance-weights used for counterbalancing pendant lamps and chandeliers, scales, or balances used by grocers and others, and for any other purposes to which balance-weights are or may be applied.

The claim is for the manufacture of balance-weights of cast iron, and afterwards coating them with brass, or other alloy or metal, by the electro-metallurgical or other process, whereby brass, or other alloy or metals, may be deposited or precipitated upon cast iron.

1099.—WILLIAM BASFORD, of 16, Talbot Road, Kentish Town, in the co. of Middlesex, engineer, for "*Improvements in apparatus for purifying coal gas.*" Patent dated May 9, 1856.

This invention has for its object, by means of the apparatus described, the purification of coal gas, and a better means of carrying out the invention for "Improvements in the purification of coal gas, and for obtaining a residuum therefrom," for which letters patent were obtained by the present patentee in 1855 (No. 2345).

This apparatus consists of an iron chest with a circular bottom, made in two longitudinal compartments placed one over the other. The lower compartment is continued at each end beyond the upper compartment, the bottom of which is inclined from the mouth-piece at each end towards the centre (say at about the rate of a quarter of an inch to each foot), so as to allow any liquid or tarry matter accumulating near the lid of the mouth-piece to flow towards the centre. To each end of the lower compartment a mouth-piece is attached, and the bottom of this is also inclined at the rate before described, and for a similar purpose. A cover or lid is fixed upon the outer end of the mouth-piece by a cross-bar screw, similar to those used to the covers or lids of retorts, so that when these lids are removed, a free passage is left all through the lower compartment of the apparatus. In each of the covers or lids of the mouth-pieces is fixed a small sight-hole with a plug, so as by removing the plug the state of the heat of the contents can be seen when the lids are closed, and the apparatus is in operation.

The upper compartment is divided crosswise in the centre by a skeleton partition, cast with and forming a part of the casting of the chest, into two chambers communicating with each other by the opening in the said partition, which partition also is intended and does strengthen the sides of the apparatus. Each of the chambers has a man-hole or opening at the top, through which the apparatus is charged with the prepared charcoal afterwards mentioned; and a lid or cap is, after the apparatus is charged, fastened thereto, in a similar way to the lids or caps before described.

The upper chambers are divided from the lower compartment by means of two iron gratings or perforated plates, which form the bottoms of the two chambers, and the top of the lower compartment. These gratings or perforated plates slide lengthwise on the top of the side-partitions to and fro at pleasure, and can be wholly removed by means of the handles when required, or they may be hinged, hung on centres, or made loose and fitted into a rebate or ledge. Both sides of the lower compartment are fitted with iron grated or perforated partitions, secured at the bottom by a groove or fillet cast upon the apparatus, and kept upright by studs cast on the centre partition, which support the grating or perforated bottom of the upper chambers, and form receptacles or pockets to receive the prepared charcoal.

In each of the mouth-pieces, attached by a nut and screw-bolts to the ends of the lower compartment, are fixed the inlet-pipes through which the gas to be purified is conducted from the retorts into the apparatus; and in the top of the upper compartment are fixed, by nut and screw-bolts, the outer pipes, to convey the gas, after passing through the heated charcoal, into the hydraulic main.

The lids or covers to the mouth-pieces are sometimes made double, either by fitting or luting against a rebate in the mouth-piece an iron plate or fire-clay tile, or by connecting the iron plate or fire-clay tile to the outer lid, in a similar way to those fitted to furnace-doors. The object of the double lid or cover is to protect the gas from the external influence of the atmosphere on the outer lid.

On the outside, and cast with the apparatus longitudinally, are small ribs or bearers, for the purpose of assisting to support and strengthen the apparatus. They are also made to receive tiles or fire-clay placed around the apparatus, which said tiles or fire-clay protect the apparatus from the direct action of the heat, and thereby secure a more uniform temperature to the vessel. The apparatus is supported in an upright position by bearers.

The apparatus is then built in a furnace, with flues under and at the sides, but not at the top—the top being left clear for the purpose of obtaining easy access to the lids or covers. Or the apparatus may be built in or over the same furnace, or even with the retorts; and the body of the apparatus may be made with fire-clay tile or brick, instead of iron; and the bottom, instead of being circular, may be flat.

For the purposes of refreshing the contents of the upper chambers, another opening is formed, with a lid or cap secured by a nut and screw-bolts, through which a pipe passes, furnished with a cock or valve, for conveying the water from the receiver to the cup placed loosely by the flange or rim on a bearer within the apparatus. The receiver is supplied with water from a cistern regulated by a stop-cock, and is also furnished with a blow-off cock.

When the apparatus is required for use, the upper chambers are filled, or partly filled, with the prepared charcoal described in the specification of the before-mentioned patent. The receptacles or pockets formed by the vertical gratings fixed or placed on the sides of the lower compartment are also filled with the same material, and a small quantity is likewise deposited over and along the bottom, so that the whole of the heated surfaces of the apparatus may thus be covered with it. The apparatus is then heated to a temperature between a dull and a bright red, when it is ready to receive the gas from the retorts.

The gas is now, in its crude state, received from the retorts, through the inlet-pipes and mouth-pieces, into the lower compartment, where, being exposed to the action of the heated charcoal, a second distillation of the products of the coal commences, evolving more gas, and precipitating the impurities. The gas then passes through the gratings or perforated plates, ascends through the prepared and heated charcoal contained in the upper chamber, and from thence makes its way through the outlet-pipes into the hydraulic main, and from thence to the gasholder.

In place of the prepared charcoal, the upper chamber, the receptacles or pockets, and the lower compartment, may be charged with ordinary charcoal, peat charcoal, or coke, either alone or in combination with saturated lime-water.

In order to assist and continue the working powers of the charcoal, or other substances before mentioned, the contents are refreshened in the following manner:—It is first ascertained whether there is any water in the cup by opening or turning on the lower cock or valve, and opening the small blow-off cock situated over the receiver, when, if there is no water in the cup, gas will be emitted through the blow-off cock. The lower cock or valve is then closed, and, by turning on the upper or supply cock, the receiver is charged with water; and when full, which is ascertained by observing when the water begins to run out of the blow-off cock, the upper supply-cock is immediately turned off, and the lower cock opened, when the contents of the receiver pass into the cup situated within the apparatus. The water is then decomposed by the heated charcoal, and passes into the upper part of the apparatus in a state of vapour, which refreshens the charcoal, facilitates the passage of the gas, and contributes to secure a uniform heat in the upper part of the apparatus.

Claim.—No claim is made to any of the parts separately; but what is claimed is, the general construction and arrangement of an apparatus in the manner and for the purposes before described.

1128.—WILLIAM EDWARD NEWTON, of 66, Chancery Lane, in the co. of Middlesex, for, "*Improved apparatus for generating illuminating gases from coal or other substances.*" Patent dated May 13, 1856.

The first part of this invention, of "improved apparatus for generating illuminating gases from coal or other substances," has for its object the conversion into gas of a large proportion of the tar vapour generated in the retorts, thereby giving a greatly increased product of gas. This part of the invention consists in so constructing the upper part of the retort as to form a circuitous passage for the escape from the retort of the gas and vapours generated from the coal or other material placed in the lower part thereof, whereby the vapours are caused to pass over or between extensive heating surfaces, and are consequently kept for a considerable time at a high temperature, which causes the greater portion of the vapour which would be condensed on leaving a common retort to be converted into permanent gas.

The second part of the invention consists in a novel kind of fastening for the moveable heads of the retorts, and which admits of the heads of the retorts being more handily and quickly attached and detached than the modes of fastening heretofore generally used, and which can be expeditiously removed from a worn-out retort, and applied to a new one.

The third part of the invention consists in a novel arrangement of flues in a bench of five retorts, whereby the flame and heated products of combustion are brought into action on the retorts in such a manner as to heat them individually in all their parts, and collectively, with a greater degree of uniformity than they can be heated in the common bench of five retorts, thereby increasing the durability of the retorts, and at the same time effecting a considerable saving of fuel.

The claim is for—

1. The construction of the upper parts of the retorts, so as to form within the retort a circuitous passage or communication between the lower part which contains the charge, and the outlet where the gas passes off, for the purpose of heating the tarry vapour sufficiently, and keeping it heated long enough for a considerable portion to be converted into permanent gas.

2. The use and application, for the purposes above set forth, of the fastening for securing the moveable heads of the retorts, such fastening consisting of a bail connected with a retort-mouth by hooked headed bolts passing through lugs on the sides thereof, and operating in combination with an inclined or curved edged rib, or its equivalent on the retort-head, substantially as herein described.

3. The within-described arrangement of the flues, by which the flame and heated products of combustion are caused to pass, first, under the bottom retorts; next, under the top retort; then under the middle retorts, and over the bottom retorts; and, finally, over the middle and top retorts, as herein set forth.

1149.—JAMES YOUNG SIMPSON, M.D., of Edinburgh, in the co. of Mid Lothian, and WYVILLE THOMSON, of Belfast, in the co. of Antrim, professor of geology, for "*The manufacture or production of lubricating oil from a new material.*" Patent dated May 15, 1856.

This invention relates to the application and use of asphaltum, especially the asphalte of Trinidad, for the manufacture or production of an oil well suited for lubricating purposes; and, in carrying out the said invention in practice, the following processes are the ones preferred for adoption:—The asphalte is first distilled at a temperature a little below what produces redness. This operation produces a thick, pitchy, liquid distillate, which is redistilled at the same temperature. The second distillate is a liquid of a slightly more limpid character, and less darkly coloured than that resulting from the first operation, whilst a residuum of fine charcoal is left in the retort. The distillate, partially purified in this way, is next subjected to agitation with about one-tenth of its bulk of sulphuric acid, when many of the impurities contained in it unite with the acid and fall to the bottom. The clearer liquid is poured off and agitated with a caustic alkali, or with a mixture of quick-lime and chalk. The liquid is subjected to washing in this way with acid and alkali alternately, until it becomes pale in colour, care being taken to remove the sulphurous acid at the termination of the washing operation. The liquid is then put into an iron retort, and distilled at a moderate heat, until about one-third of the quantity comes over. The first portion of the distillate is principally naphtha, and is set aside, and the distillation continued at a higher temperature, until the remainder comes over, leaving a very small residuum of charcoal in the retort. The liquid resulting from this third distillation is nearly limpid, containing but little paraffine; and it is this liquid which is adapted for lubricating purposes. It is not, however, suitable for such purposes alone or in an unmixed state, but is mixed with animal or vegetable oils; and the mixtures so formed possess properties rendering them very suitable for lubricating. Thus, for example, the liquid resulting from the processes before described, is mixed with rape or sperm oil, in the proportion of about one-tenth part of the oil to nine-tenth parts of the liquid produced in the manner described; but the patentees do not confine themselves to such proportions, neither do they confine themselves to the adoption of any precise temperature at which to carry on the distilling operations hereinbefore described, as the proper temperature will, in each case, be best determined by actual trial.

The claim is for—

1. The application and use of Trinidad and other asphaltum or asphalte in the manufacture or production of an oil or liquid suitable for lubricating purposes.

2. The system or mode of manufacturing or producing an oil or liquid suitable for lubricating purposes, by mixing or combining with an animal or vegetable oil a liquid obtained by distillation from Trinidad or other asphaltum or asphalte.

1182.—GEORGE CLARK, of Great Cambridge Street, Hackney Road, in the co. of Middlesex, gas engineer, for "*Improvements in the manufacture of illuminating gas.*" Patent dated May 19, 1856.

The object of this invention is to provide a means for enabling the servants of public institutions and private families, and also ships' crews, to manufacture gas for their own consumption, in an economical and efficient manner, without the necessity for costly apparatus, or the exercise of skill in the manufacture. To this end is provided a gas-yielding oil, which, unlike the vegetable oils heretofore proposed to be used in the manufacture of illuminating gas, does not contain oxygen, and will not, therefore, yield, in any appreciable quantity, carbonic acid gas; and, on the other hand, does not, like coal-tar (the well known oily product produced by the distillation of coal in ordinary gas-making), contain sulphur. From an oil thus free from oxygen and sulphur (the presence of which in gas renders an elaborate system of purification absolutely necessary), an illuminating gas is generated, and that, in general, at a rate that will about equal the rate of consumption; so that the use of a gasholder, where space is an object, may be dispensed with. This oil is prepared by distilling the rich bituminous coal known as Boghead coal, or other bituminous substance, in a retort heated to a dull red heat, and, as the vapour comes over it, is condensed in any well-known manner. This oil is applied in its crude state to the production of illuminating gas, by causing it to flow in a small stream over lumps of fire-brick, coke, or other porous matter, placed in a suitable retort set in a furnace. The oil is subjected in this retort to a cherry-red heat, and, being distributed over a large heating surface, will be quickly converted into gas; and it may then be conducted directly to the burners to be consumed, or passed firstly through water or other cooling or purifying medium. The supply of oil to the gas-retort must be regulated by a tap or valve, so as to ensure a supply commensurate with the consumption; and in some cases it is proposed to make the supply self-adjusting, by connecting the supply-cock with a gas-regulator, which, as the pressure of the gas increases therein, will proportionately reduce the supply of oil to the retort. The oil enters the retort through a syphon, or any other convenient form of "seal valve," communicating with the supply-pipe and the interior of the retort. The patentee does not claim as any part of his invention the distilling of bituminous substances at a low temperature, as above described, and thus obtaining a mineral oil free from sulphur; neither does he claim the apparatus shown for the conversion of mineral oil into illuminating gas; but, inasmuch as it has been found by repeated experiments that an oil so distilled is eminently suited to the production of illuminating gas, both from its small cost in comparison with vegetable oils, its freedom from deleterious compounds, and its property of volatilising at a low temperature (whereby the rapid destruction of the retorts is prevented), it is the introduction of this oil into the gas manufacture, and particularly in those localities and situations (as, for example, on shipboard) where a public supply is not available to the consumer, that constitutes the subject-matter of the invention.

The claim is for—The application to gas-making of mineral oils distilled from Boghead coal, or other bituminous substance, at a dull red heat, whereby the improvements in gas-making above enumerated are effected.

PROVISIONAL PROTECTION

HAS BEEN GRANTED FOR THE UNDERMENTIONED PATENTS.

2678.—THOMAS EARP, of Newark-on-Trent, in the co. of Nottingham, representative of a maltster and wine merchant, for "*A tap for measuring liquids.*" Nov. 13, 1856.

NOTICES HAVE BEEN GIVEN OF INTENTION TO PROCEED WITH THE UNDERMENTIONED PATENTS.

1660.—WILLIAM CLIBRAN and JOSEPH CLIBRAN, of Manchester, machinists and manufacturers of gas-regulators, for "*Improvements in apparatus or mechanism for regulating and measuring gas.*" July 16, 1856.

1749.—JOHN DERBYSHIRE, of Longton Potteries, in the co. of Stafford, for "*Improvements in cocks, taps, and valves.*" July 23, 1856.

1783.—HENRY REMINGTON, of Camberwell, in the co. of Surrey, gentleman, for "*An improved gas heating and cooking apparatus.*" July 26, 1856.

1835.—CHARLES THEODULE LAUNAY and JULES CHOPIN, gas-fitters, of Paris, for "*Improvements in increasing the illuminating power of gas.*" Aug. 4, 1856.

1838.—ALEXANDER WRIGHT, of Millbank Street, Westminster, engineer, for "*Improvements in lighting mines and subterranean places with gas.*" Aug. 4, 1856.

2590.—WILLIAM EDWARD NEWTON, of 66, Chancery Lane, in the co. of Middlesex, civil engineer, for "*Improved machinery for rimming and tapping gas-fittings.*" Nov. 5, 1856.

2597.—JAMES FERNIHOUGH, of Dukinfield, in the co. of Chester, boiler-maker and iron-founder, and ROBERT FARROW, of Leek, in the co. of Stafford, engineer, for "*A self-acting apparatus for regulating the supply of atmospheric air to furnaces, gas-stoves, and other closed vessels used for the consumption of fuel or combustible gases, by preventing the formation of smoke therefrom, and thereby economising such fuel or combustible gases.*" Nov. 5, 1856.

Legal Intelligence.

COURT OF EXCHEQUER.

DEC. 2, 1856.

(Before the LORD CHIEF BARON and a Special Jury.)

HILLS *v.* THE LONDON GASLIGHT COMPANY.

Mr. FISHER opened the pleadings.

Mr. KNOWLES: May it please your lordship, Gentlemen of the jury, you have found, from the opening of the pleadings by my learned friend, that this is an action brought for the infringement of a patent; and, as there abounds in this case the usual number of pleas, putting the patentee to every possible variety of proof, it is not impossible that the cause may occupy some time; but as far as it lies in me, I certainly will make it as brief as possible, by stating, in the first instance, simply to you the question as it seems to me, and without embarrassing you more than is necessary with any scientific, or, indeed, any technical terms. The cause itself will be found, in the main, I believe, to be a simple one, and will depend entirely upon the question whether the plaintiff was the inventor of the discovery which he has patented in the instrument which is before the court. Gentlemen, the plaintiff, Mr. Hills, is a manufacturing chemist, carrying on his

profession at Deptford and at East Greenwich, and he has had, from various circumstances, great acquaintance with gas; he has given it much of his attention, and the result has been that he has patented no less than three discoveries, the last being the one of 1849, which forms the subject of the patent, the infringement of which he complains of to day. Gentlemen, I think you will agree with me that the subject is an important one. The use of gas is now, I may say, universal. It has superseded every other mode of lighting our streets, and there is scarcely a building in which it is not used to a greater or to a smaller extent; and here are reasons which will be explained to you, if necessary, why the manufacture of gas should take take place as near as possible to the place where it is used. There are difficulties in manufacturing it at a distance, and conveying it by horizontal pipes; and it is therefore necessary to have the manufactory in the populous places where it is used. At the same time, there are difficulties in carrying out that object, because, in the manufacturing of gas, unless great precaution be taken, certain nuisances are apt to be engendered, and whilst, on one side, there is necessity to have the manufactory as near as possible to the place where it is used, on the other there is a due regard owing to the public health and comfort, so as to call upon the manufacturers to avoid making a public nuisance. Any man, therefore, who, by devoting his time, his skill, his science, to the study of the subject, can hit upon a plan which shall purify gas from those impurities which, if they are not removed, constitute a public nuisance, unquestionably confers a great benefit upon the public, and is amply entitled to all the protection which the law casts around the labours of scientific men. Now that is the position of Mr. Hills to day. He believes that he has discovered that which is unquestionably known to be of great use in the manufacture of gas; and if that be so, why then he is entitled to have the use of it for that very limited period which the law allows in favour of an inventor. Now, the defendants, the London Gas Company, carrying on their business at Vauxhall, seek to use and to avail themselves of the benefit of the plaintiff's invention, without paying anything for it; and if he is the inventor, they manifestly are wrong in doing so: and if the result of your verdict to day is in favour of the plaintiff, then the defendants will do what other gas companies have done—that is, they will use his invention and have the benefit of it, paying him a proper royalty or recompense for it. Now, gentlemen, you are probably aware that gas, as used for the purpose of illumination, is distilled from coal. It might be obtained from various other substances, but in practice I believe it is entirely distilled from coal. The process is this:—Certain vessels, called retorts—and which I believe are almost always composed of iron—are filled, or nearly filled, with coal, and are placed in a horizontal position; and underneath them there is a furnace, which is lighted to a certain degree of heat; and the consequence of that heat, thus applied, is to decompose the coal, to separate its various elements, and to permit the gas which is used for the purpose of illumination to issue; and, after various processes, it becomes fit for the purpose of gas. It is, as you may know, a sort of vapour, and by conducting it to a minute orifice it is capable of being ignited, and when ignited, it gives light: and it has heat sufficient to communicate with and to keep up the ignition with the gas as it continues to flow out, and to keep up a continuity of flame. Gentlemen, this gas is chiefly combined of the vapour arising from the carbon, which is by far the greatest element of the coal; and there are various other elements, which you will hear adverted to in the cause. Of these, oxygen, nitrogen, and hydrogen are the principal; and there are various substances, such as sulphur, and other matters, which you will hear adverted to in the course of the evidence. Well, gentlemen, this process of distillation—this decomposition of the coal, which separates the different elements—gives rise to new combinations; and there is gas from oxygen, from nitrogen, and from hydrogen, uniting with other vapours which are set free; and from many of these it is very desirable to purify the gas, because they are certainly useless for the purpose of illumination, and some of them are very prejudicial The further process is this:—The vapour, or the gas which is distilled by this heat from the coal, is then conducted up an ascending pipe, as you see it here [pointing to a drawing]. It is there made to descend, and it is passed into water. It then bubbles up through the water, and is then secured, because you have got it separated from the retort, and separated from any of the issues of the retort. When it has got through the water, as I tell you, the manufacturer has then to conduct it through a process which is necessary to purify it from the various matters which, as I have told you, are prejudicial to its use. Hitherto, and before the plaintiff's invention, the course appears to have been this:—When the gas had escaped through the water, it was conducted by what is called the hydraulic main to a room or tank. I do not know what the phrase will be that will be used by the witnesses; but a tank as large as an ordinary room, and lime, had heretofore been used for the purpose of purification in that tank. There were various shelves or layers, and upon those shelves the lime was placed, in either a dry or a liquid state. This lime caught the impurities, and the particular impurities, to which I will call attention in a moment. It united with the sulphur, and prevented the sulphur from escaping with the gas; and therefore, to a certain extent, the process was useful; but it was attended with great inconvenience. If you use the lime in a wet state, it produces a slimy deposit, well known to all workmen in these works under the name of "Blue Billy." This was extremely nauseous in smell, and it was necessary to conduct it away, by some underground drain, to any place that might be procured for the purpose; and, altogether, it was attended with the incidents of a nuisance. If you used dry lime, the result was not so noxious; but to a certain degree it was noxious, because whenever the lime had been sufficiently charged with the sulphur, it was necessary to remove it into a yard, and it then gave rise to a very offensive smell; and the consequence was in other respects injurious, as will be explained to you by and by. It was, therefore, extremely desirable that some other mode should be adopted to get rid of it; and I will explain to you what the plaintiff's mode was, and how he applied it. Now, allow me, gentlemen, to tell you, that of the different vapours which I have designated as desirable to be got rid of, the gas called sulphuretted hydrogen gas was the most noxious—that is, a combination of hydrogen and sulphur—a union which takes place in the decomposition of the coal; and that is, I may say, the gas which it is chiefly desirable to get rid of in the process of the manufacture. It is offensive to the smell; it irritates the skin; it tarnishes metal; and, if allowed to escape into the atmosphere, no doubt it would constitute a public nuisance. I have explained to you already how this was sought to be got rid of by lime, and the success which, to a certain extent, attended that process. I will now call your attention to the mode adopted by the plaintiff—a mode extremely simple, and I believe entirely efficacious; and, as far as I understand, unknown in its application before the plaintiff took out his patent; because you will find that, although this subject had engaged the attention of scientific men, though many active minds had been at work upon it, and though some of them might have got near the discovery without exactly knowing that they were near it, nobody before the plaintiff hit upon the direct mode of application which he has adopted. Now, the plaintiff's plan is this:—He takes a substance, called hydrated oxide of iron, some of which is here: probably I should use a correct term if I called it the rust of iron. It is the decomposition of iron, and it produces what you see before you. Gentlemen, it is essential that that should be what is called hydrated; and by hydrates is meant a substance in which water is chemically combined, though the substance preserves a solid form. But, unless it be hydrated, it is useless, or nearly useless, for the purpose of purification; and therefore you will bear in mind, that what the plaintiff uses is not merely oxide of iron, but hydrated oxide of iron, and he uses it very much in the same way in which lime is used before it is mixed with sawdust or any other porous body—the sawdust or the porous body being, of course, in greater quantities than the oxide; and it may be used in exactly the same chamber, or tank, or whatever you call it, in which the lime was formerly used, spreading it upon the different shelves, so that when the gas which is conducted through that chamber is admitted, there is an affinity between the sulphur and the oxide; the oxide absorbs the sulphur, and the result is that the gas escapes entirely free from this noxious ingredient, the sulphuretted hydrogen gas. Gentlemen, the importance of this invention will not be disputed for a moment, and I am quite certain that no witness that my learned friends may call will for one moment deny the great utility and the great benefit of this invention, although I dare say people will be found to give an opinion that the plaintiff was not the inventor. Gentlemen, that is simply, then, and in as many words as it is necessary for me to employ in the opening of the case, the main part of the plaintiff's invention. His patent, which bears date November, 1849, is expressed to be "For an improved mode of compressing peat for making fuel or gas, and of manufacturing gas, and of obtaining certain substances applicable to the purifying of the same." I may say that by a disclaimer he renounces the early part of this title, and only preserves, as my Lord will see, that part of it which relates to the purification of gas, and the mode of compressing peat, and so on, is abandoned. All that the disclaimer retains is the mode of purifying the gas. He describes it in this way: he says, "My improvements in the purification of gas consist of a method of purifying it from sulphuretted hydrogen, cyanogen, and ammonia, by passing it through the following porous material, and of renovating the material employed after it has become inert. I effect this in the following manner:—I take the subsulphates, the oxychlorides, or the hydrated or precipitated oxides of iron (which I prefer to use in a rather damp state), either by themselves or mixed with sulphate of lime, a sulphate or muriate of magnesia, baryta, strontia, potash, or soda." And he says, "I absorb them into, or mix them with, sawdust or peat charcoal in coarse powder, or breeze, or other porous or absorbent material, so as to make a very porous substance easily permeable by the gas. This material is to be put into a purifier (such a one as is used for dry lime answers the purpose), and the gas is to be passed through it; whereby the gas will be deprived of its sulphuretted hydrogen, cyanogen, and a part of its ammonia, which will be absorbed into the porous material, water being at the same time formed by the union of the oxygen of the oxide and the hydrogen of the sulphuretted hydrogen absorbed." That is, therefore, his account of the first part of his invention; but you will find that the invention embraces a second part, which is not less material; because, as you will easily imagine, when this porous mixture has got surcharged or saturated with the sulphur, of course it is not then capable of retaining more, and it is necessary either to change the material for fresh material, or in some way to purify it from the sulphur which it has absorbed; and Mr. Hills' invention for that is extremely simple. He discovers, in course of his experiments, if you admit the atmospheric air to this material after it has absorbed the sulphur, that the action of that air is to revivify it, and re-oxidise the mixture; and in a short time the mixture charged with the sulphur changes its colour from black, which it had become in the progress of receiving the sulphur; it gradually gets to the colour of hydrated oxide, and is then re-oxidised, and can be used over and over again for the same purpose. Now, that is in every way extremely material. It may be done in the vessel in which the purification takes place, by simply removing the conducting-pipe to another vessel—I mean the conducting-pipe which leads the vapour—by removing it and leaving the orifice open to the atmosphere; the atmosphere flows in by degrees, and the purification and the re-oxidation takes place, and the material is then again ready to go through its work. He describes this in a subsequent part of his specification; and it consists, in fact, of that which I have stated to you. I do not think it necessary for me to read it to you in his own words. Now then, gentlemen, I have simply stated to you, and at as great length as seems to me to be necessary, the object and mode of the plaintiff's invention. I must now advert to the different pleas which have been put on this record, and to the various heads of defence to which your attention has been directed. The pleas you have heard, or some of them. We are told that they do not infringe—that the plaintiff is not the first inventor—that there was no novelty, and so on. Of course I shall have to satisfy you that he was. They then take objection to the specification, and say that it is not merely a new manufacture,—they say that the invention described is another and different invention to that for which the letters patent were granted, and so on, as I collect from the notice which it is necessary for the defendant to give of the matters upon which he means to rely. Gentlemen, I may observe, that various objections will arise upon previous letters patent which had been granted to the plaintiff himself, and have also been granted to other people. I believe that the main patent that will be relied upon, will be the patent of Mr. Laming, and that the plaintiff's invention is one which is said to have been practised at the Gaslight and Coke Company at Westminster, before the date of the plaintiff's invention. Now, gentlemen, I am prepared to expect that something of this sort, therefore, will be given in evidence; and I will only make this observation upon it to prepare your mind for its importance. If it be true that in Mr. Laming's patent the invention of the plaintiff is patented—if it be true that at these works at Westminster, under the direction of Mr Laming and his partner, Mr. Evans, this invention was practiced before, or patented, it will be a most extraordinary thing, when I tell you that these very parties, the pretended patentee, Mr. Laming, and the pretended inventor, Mr. Evans, have actually been working our patent by licence for us for several years, apparently quite unconscious that they had found this out, or had the means of working it under any invention of their own. I say it would be strange if these gentlemen can come before you and tell you that they actually had the means of practising this invention without paying any royalty at all; if they have, year after year, and after litigating proceedings in these courts; if they have actually submitted to take out a licence from us and pay a royalty for it; If the case rests, as I believe it will, upon the evidence of these gentlemen, I think, when you are considering the effect of it, you will set against their evidence the potent evidence given by their own conduct in the transaction. I make that remark because I collect from these notices that that will be the principal objection, and you will, when this has been proved, consider

what it is worth. I will now, gentlemen, proceed to prove my case. I will call various scientific gentlemen before you, some of them of the very highest name in science, and they will tell you that this invention was at the time new, and they will also give the necessary evidence respecting its utility. When I have produced these witnesses, of course I shall put the plaintiff himself into the box; and in the result, unless my learned friends should meet my case by evidence stronger than that which I am prepared to expect, I believe the end of the case will be a verdict for the plaintiff. And, gentlemen, it is right, if the plaintiff be the inventor, that it should be so. There is no class of people in the world to whom society is more indebted than to scientific men, who devote their time, their brains, and long study and research to discoveries which, in a greater or less degree, are useful to mankind. The law protects their discoveries for but a limited period, and it is right that they who invent should have some benefit from the invention; but unfortunately it happens, in proportion to the benefit of the invention, that when an inventor does hit upon a matter which gets into common use, and of necessity must get into common use, he is obliged, through the whole fourteen years of protection, to fight his way, step by step, by expensive litigation. Every stage of those years is marked by some battle or other—every difficulty is thrown in his way—every imaginable plea is put upon the record; and it frequently happens that, though successful at last, the repeated applications which he has to make to the courts of law for protection absorb all that is useful to him in the profits arising out of that which he has invented. I hope that that will not be the case with this invention; its utility you will not, I am sure, doubt. It has now been in use since 1849, and I trust your verdict to-day will secure the plaintiff from any future interference with his right, and let him for the remainder of his patent enjoy that to which he is, in my opinion, so justly entitled.

Mr. Hills' specification, and the disclaimer, by Mr. Hill, to the patent of 1849, filed the 27th June, 1856, were put in.

Dr. *Alfred Swaine Taylor:* examined by Mr. GROVE.

I am a professor at Guy's Hospital. I have paid a general attention to gas manufacture, and the subject of this patent. Before the present action, I was called on to look particularly into the patent.

Will you shortly state what the old mode of purifying gas was before this patent was taken out?—The old mode, as applied to the particular impurity involved in this question—the sulphuretted hydrogen—consisted in causing the gas to pass through what were called lime purifiers, in which the lime was sometimes in a sort of creamy state with water; and at other times, when in a more improved state, it was in what we call a hydrate—that is, a kind of powder—a moist powder, spread upon hay or moss, or substances of a permeable nature. This had, to some extent, the effect of absorbing the sulphuretted hydrogen—to as great an extent as was known at the time. These were called, I believe, wet-lime and dry-lime purifiers. The disadvantages of those purifiers were, that the lime did not fix entirely the sulphuretted hydrogen. It acted well for the ammonia; but I believe no gas was obtained by those purifiers which did not contain some of the sulphuretted hydrogen. The purification, as to the sulphuretted hydrogen, was incomplete.

Will you now state the present plan of Mr. Hills, the patentee?—The present plan consists in passing the gas through a bed of lime, in the first instance, by which the carbonic acid is arrested, some of the ammonia and some of the sulphur; and it is more economical to separate as much as possible by the lime, in the first place. The gas then passes through a bed of hydrated oxide of iron, which is made porous for its passage by sawdust, wetted, so as to absord and fix the gas to a certain extent; and by these means the sulphur is taken out of the gas, and the iron is converted slowly into the sulphuret of iron. In my opinion, it succeeds in arresting the sulphuretted hydrogen most effectually; it also fixes other impurities. It fixes the cyanogen most completely, the ammonia partially, and the sulphur entirely. Sulphuretted hydrogen is a very noxious ingredient, not merely from its offensive smell and its poisonous nature, but even in burning, if any trace remains in the gas, when burnt it becomes noxious, from forming sulphurous acid. The invention, in my judgment, is a most useful one. I have mentioned the hydrated peroxide as being the hitherto sole ingredient. There are two other ingredients mentioned in the specification—the subsulphates and the chlorides of iron—which are practically useful. There are certain salts which the specification says may be mixed with the hydrated oxide. They would be found mixed according to the cheap mode of making the hydrated oxide. The oxide, with those mixed, would succeed; not so well as the oxide in a free state; still it succeeds in stopping the sulphuretted hydrogen. In several cases it would be more economical to use them mixed than to go through the troublesome process of separating them.

You are acquainted, I presume, with the second part of the invention, as to the revivification of the material?—Yes. After the iron is saturated with the sulphuretted hydrogen—that is to say, when converted into sulphuret of iron—the gas, in passing through, would pass through impure, unless something was done to renovate it. It is accordingly removed from the purifier. In that state it is a black powder—iron combined with sulphur, mixed with a great deal of water. It is thrown on the floor in the room with a tolerably free access of air, at a moderate temperature; and then it undergoes a chemical change—the oxygen of the air fixes itself upon the iron, and it reforms the oxide of iron, the original material, and the sulphur which was in the gas is separated as sulphur. It smokes; a quantity of steam is given out; and a portion of carbonaceous vapours, the gas, escapes. But the result of this revivification, by stirring the black mass, and exposing it freely to the air, is to re-convert the sulphuret of iron to the state of oxide of iron; so that it is in a state to be used again with sawdust, and purify the gas again.

The LORD CHIEF BARON: What becomes of the sulphur? It is locked up mechanically in the midst of the material. There is a small quantity of sulphuric acid to be found; but it remains chiefly as sulphur. In the future process, it blocks up the material to a certain extent, it becomes so large in quantity; so that the revivification consists in the spontaneous conversion by exposure to the air, and this conversion is into oxide of iron again. A small quantity of sulphuric acid would be formed. This process of reduction and revivification goes on a long time. I saw some in the City Gasworks, which I was informed had been in use six or nine months.

How often had that been used?—I can hardly answer that question; but a great many times: speaking conjectually, I should think 20 or 30 times, or more.

Mr. GROVE: Have you in your hand the hydrated peroxide charged with sulphur? This appears to be a mixture for receiving the gas for purification—the gas being let in at *this* end (pointing to a tube.) *This* [pointing to a bottle] appears to be the hydrated oxide of iron, mixed with the sawdust; and the gas being let in from a pipe at this end [again pointing], would slowly ascend, and pass through this porous material; and there is a piece of test-paper above to let one judge whether it is arrested by the iron or not. If the iron is in a proper state, that blackness at the lower part goes on until the whole is blackened. *That* [pointing to a bottle] is the state previous to use; *this* the blackened state after being used.

In addition to examining the works where Mr. Hills' business is carried on, have you made experiments yourself?—Yes; in both, the hydrated, oxide was perfectly successful. Properly used, it arrested the sulphur. The common peroxide, without being combined with water, would not produce the same effect.

The LORD CHIEF BARON: By "hydrated oxide," do you mean, as the learned counsel said, chemically combined with water, or merely the oxide in a damp state?—I mean water chemically combined with the oxide, so that you would hardly know that there was any quantity from the appearance.

Examination resumed: Wherever the oxide, if chemically precipitated, falls in water, it falls as a hydrate, if combined with a quantity of water, which cannot be separated at 212°; a heat of 212° will get rid of mere dampness in oxide of iron. Oxide of iron not hydrated, not being combined with water, might, if damped with water, succeed, under circumstances, but not in the way contemplated in this patent. To remove combined water from hydrated oxide of iron would require a full red heat continued for some little time; the temperature would be 800° or 900°. The hydrated oxide is quite distinct from the oxide without water, in other chemical properties. I have read the specification carefully. That of 1849, is sufficient to instruct a person practically acquainted with gas manufacture. In my judgment, the invention, at the date of the patent, was a new one.

Cross-examined by Sir F. THESIGER: The time when I was called on to look into this question before the action, was the beginning of 1853. My attention had previously been called to the manufacture of gas; my attention was called, in 1853, to the purification of gas by the oxide of iron. Before that time, I had not known of the use of oxide of iron for the purpose of purifying coal gas. It had been a common course to purify coal gas by passing it through porous substances, such as hay, lime, or moss; I had known that since 1831 or 1832. I do not know that it had been common to expel sulphuretted hydrogen from lime, by means of hay, or by the removal of atmospheric pressure upon the porous bodies, nor by means of heat. The lime was always spoiled, spent; and fresh lime was bought. Nothing but lime was used to pass coal gas through. There is a difference between "precipitated" and "hydrated" oxides; the precipitated is always hydrated, but the hydrated is not always precipitated. There are natural hydrated oxides as well as artificial; they are found native.

The LORD CHIEF BARON: To any large extent?—Yes, my Lord. What is called brown hematite iron is obtained from that very often.

Cross-examination resumed: I do not think that the native hydrates can be employed for the purpose of purifying gas; I have tried the experiment. The term, "artificial hydrates" of iron, is well known in the scientific world, as contrasted with "native." It is not a term that a chemist would use. If we spoke of "hydrated oxide" of iron, I should understand, chemically, a precipitated oxide. I should not think that a person was referring to a native hydrate, unless he specially mentioned it. I am acquainted with the work of Berzelius. It is one of the first works that we have. As early as the publication of his work, the term "artificial hydrated oxides" was used. It would be a strange term for Berzelius to use.

Sir FREDERICK THESIGER read a passage from Berzelius, which the witness said referred to "artificial hydrated peroxide of iron."

Cross-examination resumed: You say that the sub-sulphates and the oxychlorides are, in fact, the hydrated oxides?—With a very small quantity of chlorine and sulphuric acid. When I said that, if the iron was in a powdered state, it began to blacken, I meant in a state of hydrate as obtained artificially by precipitation, mixed with some porous material and wetted. It will do it without. The action will take place without the wetting, but the wetting appears to attract the gas to the iron, to fix it, and make it more effectual. The hydrated oxides of iron will do by themselves, without the admixture of something else; but the objection then is, that they form so close a material as to interfere with the passage of the gas. Chemically they will answer.

The LORD CHIEF BARON: Practically they would not, because they would block up?—Yes, and form a kind of jelly, which prevents the free passage of the gas. They will act chemically most satisfactorily. It is only that a certain amount of pressure exists in the manufacture of gas which is to be considered; and if that pressure is increased by the nature of the material, it will of course affect it.

Cross-examination resumed: Previously to the patent of Mr. Hills, I never heard of oxides of iron being applied to purify gas. I have referred to Berzelius, Dumas, and those who have dealt with this matter, but I cannot find any trace whatever of their having been so used. I have heard of the patent obtained by Mr. Croll. I never knew that he proposed to use oxides of iron for the separation of the sulphur.

Croll's patent being referred to, Sir FREDERICK THESIGER pointed out to the witness the words, "The same effect may be produced by the application of the oxide of zinc and the oxides of iron;" and the witness then stated that his answer to the learned counsel was rather in reference to the use of iron and the sulphur; but he now saw that oxide of iron was here spoken of for separating the ammonia.

The LORD CHIEF BARON: The beginning of the paragraph is this:—"The third part of my improvements is the manufacturing of coal gas, and consists in the application of the black oxide of manganese to remove or free coal gas of sulphuretted hydrogen, which is accomplished in the following manner."

Cross-examination resumed: The first process is for the purpose of removing the ammonia. Afterwards, the material is treated with the different substances which are mentioned; and, for the purpose of purifying, "the same effect may be produced by the application of the oxide of zinc and the oxides of iron, and treated precisely in the same way as above described."

Sir FREDERICK THESIGER pointed to another portion of Mr. Croll's claim:—"I claim the purification of coal gas from ammonia, by means of chloride and sulphate of manganese, and muriate of iron, and sulphuric and muriatic acids; and the purification of gas from sulphuretted hydrogen by means of the oxide of manganese, the oxides of iron, and the oxide of zinc, as hereinbefore mentioned and hereinbefore described, as applied in the particular manner and stage of the process of the manufacturing of coal gas, hereinbefore mentioned, and not otherwise." Does he claim (the learned counsel asked) to use oxides of iron for the purpose of purifying coal gas?——

The LORD CHIEF BARON interposed: The claim is of very little importance. There is no doubt that he claims it.

Sir F. THESIGER remarked, that Mr. Croll first of all used certain salts to remove the ammonia, and before he applied his oxides of iron to the purifying of gas from the sulphuretted hydrogen.

The witness having assented, the learned counsel turned to page 13 of the plaintiff's patent, and his specification, and asked the witness whether he also did not propose to remove the ammonia before he applied the hydrated oxide of iron for the purpose of removing the sulphuretted hydrogen. He then quoted from line 38 of the specification:—"Before submitting the gas to the action of the purifying materials before mentioned, I prefer first to take away the greater part of the ammonia by means of a water-scrubber, or by any other plan that may be preferred, and then to pass the gas through the porous purifying material before mentioned, to remove the sulphuretted hydrogen and cyanogen."

The LORD CHIEF BARON inquired what was the water-scrubber?

Sir F. THESIGER replied: I suppose a scrubbing with water.

The *Witness* explained that it was a kind of vessel in which a quantity of coke is put, and a quantity of water is then put in. The water fell upon the coke, and the gas was supposed to scrub against the coke.

Sir F. THESIGER remarked that both the plaintiff and Mr. Croll proposed to remove the ammonia before applying the oxides of iron to expel the sulphuretted hydrogen.

The *Witness* replied: I think it was part of Mr. Hills' process. He considers it better to take the ammonia away first; but his plan will answer whether it is taken away first or last. I cannot tell whether Mr. Croll's plan would equally remove the ammonia after the sulphuretted hydrogen as before, but the acids and solutions which he uses are calculated to stop the ammonia. I know that there is a carbonate of iron, so called; but it is a misnomer: there is not a carbonate; it is a peroxide of iron. The hydrated oxide of iron was formerly called carbonate of iron or sub-carbonate of iron, and was used in medicine.

The LORD CHIEF BARON supposed that, if so called in pharmacopœias, it found its way into some encyclopedias, dictionaries, and text-books of chemists?

The *Witness* replied in the affirmative, adding that it was not so well known then as it is now.

Cross-examination resumed: The revivifying process—the re-oxidising of the material—is merely exposing it to the free access of the air; and then the colour, which was black, after the process is gone through, is restored to the red colour which existed before, and is capable of purifying again. In other words, the iron leaves the sulphur, and forms a new attachment to the oxygen. Before this period, it was known that this sulphuret of iron would become revivified by exposure to the air. It is mentioned by Berzelius. It was known, as a chemical fact, that by the exposure the sulphuret of iron would be separated, and that the iron would be reconverted into peroxide.

Will you be good enough to give the distinction between "oxide" and "peroxide?"—The oxide is the first degree of oxidation, where one equivalent of iron is united to one equivalent of oxygen, and is quite a different substance from the peroxide, which means a higher degree, and is the state in which there are two equivalents of iron combined with three equivalents of oxygen, or one to one and a half; so that the peroxide contains half an equivalent more than the oxide. The hydrated oxide of iron is now known as the hydrated sesquioxide; but the term "hydrated oxide" might imply either the oxide, the proto-salts of iron, or the other. It was not formerly called the ferri-sesquioxide: that would be very incorrect. I am not aware that, as early as 1836, the hydrated oxide was known by that name. I knew the "London Pharmacopœia" of that year; but that is no authority in chemistry. I cannot say whether it was so called in that book. They used to call the sesquioxide of iron the carbonate of iron for many years after chemists gave it up.

Re-examined by Mr. GROVE: When I was first called in, it was not as a witness, but an arbitrator. Reading this specification of Mr. Hills' patent, as a chemist, I would not apply it to native hydrated oxides of iron, because that is guarded against by the use of the term "precipitated" Native hydrate is found very often in a brownish powder, but the particles are more closely aggregated than in the precipitated oxide of iron. Comparing the two would not be like comparing rock with mud, but coarse sandy matter to very fine powder. No mention is made of native in the specification, nor anything in it to lead me to consider that the patentee contemplated native. I should say certainly not, from the use of the term hydrated or precipitated, which is used more than once. At page 14 the patentee gives the mode of preparation of what he calls the "hydrated or precipitated." There is nowhere in Mr Croll's specification anything about hydrated oxides; there are simply the words, "oxides of iron." Mr. Croll's specification says: "This material, after it has ceased to absorb the sulphuretted hydrogen, is to be removed from the purifying vessel, and roasted in an oven to expel the sulphur, which it then contains. After this material has become thoroughly red in the oven, I have found from two to three hours' further time to be sufficient to accomplish this object, taking care that whilst it is being roasted it will be well stirred about in the oven. After this operation is completed, the material is fit again to be employed, by being placed in the purifier, moistened with water, as in the first instance." An oxide so prepared would be a perfectly inefficient oxide; it would be anhydrous, and have no effect whatever in purifying gas from sulphuretted hydrogen; it would not be a hydrated oxide. I have tried the oxide of manganese, and it is a perfect failure. I have tried the oxide of iron, roasted in the way he describes, and that also is a failure; it does not separate the sulphuretted hydrogen.

The LORD CHIEF BARON said, he collected from what Professor Taylor stated that, if the hydrate were exposed to a red heat, not only would the sulphur be expelled, but the water also.

The *Witness* said such was the case. He added, "Oxide of iron," *simpliciter*, would be an ambiguous term; without the context, one could hardly form an idea of its meaning. Oxide of iron would not mean hydrate, unless specially mentioned. The oxide of iron which is commonly found in shops is in an anhydrous state. Referring to page 13, line 33, of Mr. Hills' specification, he says: "I prefer to effect the renovation of the purifying material without withdrawing it from the purifier, by exposing it to the influence of the atmosphere, which may be either admitted to it, or be drawn or forced through it by any suitable means, whereby the iron will become re-oxidized, and fit for again purifying the gas. Before submitting the gas to the action of the purifying materials before mentioned, I prefer, first, to take away the greater part of the ammonia." That (said the witness) does not appear to be part of his invention or patent, but merely a mode which he prefers. The revivification of the sulphuret, previously to this patent, was known as a chemical fact; but its application to the manufacture of gas was unknown. It would be tried by chemists with pure sulphuretted hydrogen; as a gas manufacture, it would be tried on a large scale on the gas, with divers mixtures. Berzelius mentions it He mentions the purification of gas, but makes no reference to that. In his volume, he specially speaks of the means of purifying gas, but does not say anything about it. It would require an experiment to ascertain whether such a process would succeed for the purification of gas. What is called the carbonate of iron contains some small proportion of carbonic acid. I tried an experiment on it. There is a portion as carbonate, but mixed with oxygen. A person would not, by "carbonate," understand "oxide;" certainly not.

Professor *William Thomas Brande* sworn, and examined by Mr. HINDMARSH.

I have the superintendence of some parts of the Mint. I am also an experimental chemist, and have paid attention to the subject of gas manufacture. I believe I am acquainted with most of the various chemical reagents which were employed to purify gas before the date of this patent, in 1849. I have carefully read Mr Hills' specification, as altered by his disclaimer. The term, "hydrated oxide of iron," is mentioned in it. As a chemical fact, that is distinct and different from the anhydrous oxide.

The LORD CHIEF BARON supposed that Sir F. Thesiger would not dispute that.

Sir. F. THESIGER said he did not.

Examination continued: I have seen the oxides applied in the purification of gas, both the hydrated and the anhydrous. The hydrated succeeds. It is very efficacious in purifying gas from sulphurretted hydrogen chiefly; it will also take up cyanogen; and, when prepared in the way directed in the specification, it will partially take up ammonia.

At the suggestion of the LORD CHIEF BARON, the examination was not continued on points which the cross-examination of Professor Taylor showed were not in dispute.

Examination resumed: The anhydrous I have also tried; it will not succeed. With regard to Mr. Croll's specification——

The LORD CHIEF BARON thought the learned council had better wait for the cross-examination on this point.

Examination resumed: I have heard Professor Taylor's evidence, and I agree with it.

Cross-examined by Sir F. THESIGER: I agree with him, both in his examination in chief and in his cross-examination.

In reply to supplementary questions of Mr. HINDMARSH, the witness stated that native oxides were ores of iron of various degrees of purity—some very pure, others very impure—in a very different state of aggregation from the precipitated oxides.

Sir F. THESIGER: Professor Brande has stated that he agrees with Professor Taylor, both in the answers that he gave in his examination in chief, and the answers that he gave in cross-examination.

Mr. KNOWLES: Do you mean that he agrees with him as to what he said about Mr. Croll's patent?

Sir. F. THESIGER: Yes.

Mr. KNOWLES objected to that form of cross-examination. The witness should be asked specific questions, and then he could be re-examined on the points.

Sir F. THESIGER: Why should I question Professor Brande particularly, when I am quite satisfied with the answers Professor Taylor has given?

A short discussion took place, and then another witness was called.

Mr. *Frank Clark Hills:* examined by Mr. KNOWLES.

I am the plaintiff in this action. I am a manufacturing chemist, and have works at Deptford and Greenwich. For many years I have paid great attention to the purification of gas, and have studied the subject. I took out, in 1849, the present patent; and I disclaimed in the way which has been stated. I pursued the experiments that led to the discovery embodied in my patent, at my works at Deptford. The Deptford Gas Company's works adjoin my premises; and I had a pipe laid on from their works to mine. I tried a great variety of agents, besides hydrated oxide of iron; and, at last, arrived at the discovery that the sulphuretted hydrogen gas could be completely removed by being passed through this porous mixture of hydrated oxide and sawdust. To my knowledge, this process had never been adopted before. I had been acquainted with various gas-works, and seen their modes of purification, but I never saw this mode in use before I have stated that it is more convenient to use it with sawdust, or some other porous matter; but, without being used with sawdust, it would succeed very well. By being damped, it also forms a porous body, but not so efficiently as with sawdust. My mode of renovation, or re-oxidation, as far as I am aware, is a new application. Supposing it to be known, as a general principle, that the addition of atmospheric air would revivify the oxide, it would, nevertheless, be the subject of a good deal of experiment before it could be applied to purifying by this oxide. Where pure sulphuretted hydrogen might answer very well, when mixed with hydro-carbon, sulphur, and the other various gases which exist in coal gas, I do not think it follows, by any means, but that it would require a very great many experiments before that could be ascertained. I believe, as a chemical fact, it was stated in the chemical books, that, after renovation, the iron would be left in the shape of hydrated oxide; but I believe, it was never known or applied in this way. I never heard of such a thing. I believe I am acquainted with all the various patents which have in view purification from some of the impurities which exist in gas. None, that I know of, have pointed to my process. I know Croll's patent. It does not work as mine does; it is a totally different process. Of course, I know what is called native oxide. It is sometimes found hydrated. I never found it in a pure, or nearly pure, state; it is mixed with silex and other things, but totally different from precipitated hydrogen.

As far as you know, were you the first inventor of this application?—I was, to the best of my knowledge.

Cross-examined by Sir. F. THESIGER: The date of my patent was originally November, 1849. I do not know a word about the disclaimer.

The disclaimer petition was applied for in 1853; you petitioned for a disclaimer. Why comes it that you did not enrol it until nearly three years afterwards—till the 27th of June, 1856?—I think my solicitor can answer that question best. I think it was because the question was settled by arbitration, and there was no longer occasion for doing so. I brought an action against Laming and Owen; and at that time we came to a compromise, and they agreed to pay me a certain royalty. There was no occasion to go any further in it. It was in my solicitor's hands. Why he did not do it, I don't know. I think the action was not brought before the disclaimer; I do not remember exactly. The arbitration was, I believe, in 1853 or 1854. The reason why I suffered two years to elapse after the arbitration, before the disclaimer was filed, I have given you; the question was settled, and there was no longer any occasion to file the disclaimer; and now another action has arisen. Laming had a patent in 1847; I had mine in 1849: the arrangement was not that each should be considered as valid, and should be parcelled out to the different gas companies. I believe the arrangement was, that we were not to inquire about the matter. The arrangement was as to the hydrated oxides, which was agreed to be my patent; whichever used them was to pay me a royalty; and if the gas companies used anhydrous oxides, which was Laming's patent, they were to pay a royalty to him. It was agreed that certain gas companies should be parcelled out amongst us. I commenced my experiments at Deptford as early as 1846, I think. I took out a patent then, when I thought I could use oxides of iron; but I did

not succeed at that time. In 1846, I was aware that Mr. Croll had pointed out the oxides of iron as a substance which might be used for purifying gas. In July, 1849, I obtained permission from the Chartered Gas Company to make experiments in purifying their gas from ammonia, not from sulphuretted hydrogen. I used there what they call a scrubber—a vessel filled with sawdust, over which water was caused to spread to make it damp. It was like an immense sponge, which absorbed the ammonia, and took it away from the gas. While I was so employed at the Chartered Gas Company's works, I heard that Messrs Laming and Evans were also employed upon other experiments. I think I heard from Mr. Evans that he was going to try Laming's patent for taking away the ammonia from the gas. I did not see Mr. Laming experimenting upon the purification of gas. My brother went up there occasionally while my experiments were going on. He is here. He does not assist in my works; he does in the mercantile part of my business. I mean to say that I do not know that Mr. Laming was making experiments there upon oxide of iron. Mr. Evans did not inform me that they had discovered, almost accidentally, a means of revivifying material which had been used, and applying it again for the purpose of purification; he never mentioned a word to me on the subject, till long after my patent, —a year or two, I dare say. I applied to the Attorney-General for my patent in November, 1849, and deposited a paper describing the nature of my invention. I believe this [paper produced] is a copy.

Looking at that document, where do you find any application for a patent for using oxides of iron for the purpose of purifying gas?—"For absorbing sulphuretted hydrogen."

You are referring me to, "For absorbing sulphuretted hydrogen and other gases into porous bodies, and removing them again, either by heat, &c., or taking off the atmospheric pressure." Now, do you not know, as we have heard from Professor Taylor, that it was perfectly well known and common to use porous bodies for the purpose of passing foul gas through to remove its impurities?—I should differ from Professor Taylor. There was no porous body that I know of used before that, to take up sulphuretted hydrogen, to any extent. Gas was previously purified by lime. That is a porous body, and gas was passed through it; lime was porous, no doubt.

Sir F. THESIGER desired the witness to point out in the deposit-paper anything else to show that his application was for a patent to use oxides of iron.

The *Witness* replied: When I went to the Solicitor-General to make this application, I was opposed on this patent; and at that time we made a verbal declaration. I had no written paper with me at all. I was requested then to write one; and I wrote it, in a very hurried manner, at the Solicitor-General's chambers. My solicitor had my papers; and I had to borrow the back of a letter from the Solicitor-General's clerk, on which I wrote it. It was the merest outline of what my plans were; nothing like a specification.

The LORD CHIEF BARON desired the witness to point out, on his deposit-paper, any suggestion that he was applying for a patent for the revivifying or reoxidising process.

The *Witness* read: "For absorbing sulphuretted hydrogen and other gases into porous bodies, and removing them again, either by heat, &c., or taking off the atmospheric pressure."

Sir F. THESIGER asked where was the application for exposure to the air?—That is exactly what happens. I think it is not at all requisite in a deposit-paper, which merely gives an outline of what the patent is for. I did think that this was quite enough. I was experimenting upon other substances, which I intended to include in the patent. I intended to include them all, as well as the oxides of iron; and I think the description given is quite good enough. By exposure to the air, the sulphuret of iron is decomposed, and a small portion only of the sulphuretted hydrogen is removed; the other gases are removed. I gave a process afterwards for condensing those gases. I did not give it as a specification; but I supposed it quite sufficient for the Solicitor-General; if not, he would have required more explanation—if it had not been quite clear what my patent was for. Mr. Laming afterwards applied for a patent for this revivifying process. I opposed him before the Attorney-General, and his patent was refused. I suppose I had taken out eight or ten patents before; I don't know many; it may be a dozen. All of them related, more or less, to chemisty; no, some were connected with mechanics and steam-carriages; many have run on the common roads. I don't know when I first complained of the defendants, this gas company, infringing my patent; I think a year and a-half or two years ago. I believe I brought the action the day after I filed my disclaimer.

Re-examined by Mr. KNOWLES: As far as I know, though I left the business in the hands of my attorney, the disclaimer was not previously filed, because the litigation between me and Mr. Laming happened to have been settled by arbitration. I opposed the application of Laming and Evans for a patent; and the Attorney-General, Sir John Romilly, would not admit that part of the deposit-paper which claimed to purify gas by the application of hydrated oxide. I brought a *scire facias* to repeal that part of their claim, and I believe it was repealed.

An objection raised by Sir F. Thesiger to this evidence was discussed, and the Lord Chief Baron decided that he could not take down that the patent was taken out, and that a *scire facias* was issued afterwards.

Mr. KNOWLES said he would prove what the deposit-paper was, and what was struck out of it, and perhaps he should have time to get the repeal.

Re-examination resumed: An arrangement took place in 1853, by which certain companies were given to Messrs. Laming and Co., and others to me. When they used the hydrated oxide, I was to receive a royalty; when I used their anhydrous process, I was to pay a royalty. I have never used their process; I knew perfectly well that it would not purify the gas; I have consequently never paid them a penny of royalty. They, on the contrary, have constantly paid me from that time a royalty for the use of my process with their companies. Mr. Evans was not one of the partners with Mr. Laming; he was engineer and manager of the Chartered Gas Company, —one of the companies supplied by Laming and Co. with my process, and still using it, and paying a royalty for it.

Mr. Knowles attempted to re-examine on the deposit-paper, with a view to ascertain the construction put upon it by the witness, but Sir F. Thesiger objected, and the Lord Chief Baron ruled that he could not take the evidence.

In the course of the discussion, however, the witness stated that he imagined that the words, "for absorbing sulphuretted hydrogen and other gases into porous bodies," in the deposit-paper, covered the use of oxides. The Lord Chief Baron said he could not take this down, and then asked for the original deposit-paper, written on a scrap of paper at the Attorney-General's chambers. The witness further stated that he was acquainted with his discovery at the time he gave in his patent.

The LORD CHIEF BARON remarked, that it might turn out that the Attorney-General had no right to require the deposit-paper; but, whatever its value, it must, as a written document, speak for itself.

Re-examination resumed: Oxides are very porous bodies, and especially so when mixed with sawdust or breeze. Some were in the shape of stone, and could scarcely be called porous.

Mr. KNOWLES asked the witness whether page 13 of his specification, line 6, and the subsequent portion, pointed out the mode of taking off the atmospheric pressure mentioned in No. 5?

Sir F. THESIGER objected to the witness being asked for his explanation of the terms. He, however, read them as follows:—"As soon as the material ceases to purify gas from sulphuretted hydrogen, the gas is to be shut off from the purifier, and a communication is to be opened to the external air, which is to be admitted to the purifying material, and by the agency of which it will be renovated, and the uncombined gases which have been absorbed will be driven off."

Witness: By doing so the air is driven through the material, and it is very readily oxidised. Heat is also generated at the same time, and ammonia and other gases are driven out. The generated heat is so great, that if you admitted it too fast it would set it all on fire.

Professor *W. A. Miller*, M.D., F.R.S.: examined by Mr. GROVE.

I am professor of chemistry at King's College. I have paid attention to improvements in gas manufacture. I have looked at the different patents upon the subject—at a certain number of them chemically. I have made myself acquainted with the plaintiff's invention. It consists of applying hydrated peroxide of iron for the absorption of sulphuretted hydrogen from coal gas, and the revivifying of the material, so that it may be used after it has been rendered inert. The invention would be useless, economically, without the second part of the process. At the date of the patent the invention was new, so far as I am aware. It was known that sulphuretted oxides would be again oxidised by exposure to air, but I do not think the question had been examined as to whether the oxide was hydrated or not. As far as I am aware, it had never been thought of that the oxides could be rendered fit to reproduce their effect on the gas. There is a difference between hydrated oxides and oxides anhydrous. The latter will not produce the effect. I think the process is sufficiently described in the specification to enable a chemist acquainted with the gas manufacture to practise it.

Cross-examined by Mr. HILL: I speak as a scientific chemist, but I believe that a mere practical gas-maker would understand the specification. Anhydrous oxides of iron had before been applied in purifying gas. Oxides generally are claimed by Mr. Croll; they were also previously known in the purification of gas. My attention was first called to the plaintiff's invention before he specified; I mean, particularly to the application of oxides of iron to the purification of gas. I was also aware of Mr. Laming's patent. Croll's also attracted my attention. In the course of the experiments, it came out that the native hydrates would not purify. I made several experiments at Mr. Hills' works, during three weeks between the date of the patent and the drawing of the specifications. I experimented on the anhydrous oxides as well as others. First, on certain mixtures which were used by Mr. Laming in his specification; then on a mixture, the hydrated and anhydrous oxides of iron, and upon the sub-sulphates and the oxychlorides of iron. The objects of the experiments were to ascertain whether there was any sulphuric acid; whether sulphate of ammonia was formed; whether, when mixed with certain salts, the oxides of iron would be revivified by exposure to the air; and whether the presence of certain salts—deliquescent salts, for example—would retard it.

Re-examined by Mr. GROVE: I have seen Mr. Croll's specification, and recollect his direction as to roasting the material. If he used a roasted oxide, most undoubtedly it would be anhydrous. I am not now aware of anybody using the hydrated peroxide before the plaintiff. The hydrated oxides were part of Mr. Hills' discovery.

Dr. *Stenhouse:* examined by Mr. HINDMARSH.

I am professor of chemistry at St. Bartholomew's Hospital. I have made myself acquainted with the various processes for purifying gas which were known and in use before the date of this patent—with a considerable number of them at any rate—more particularly with regard to the purification of gas from the sulphuretted hydrogen. Before the date of Mr. Hills' patent, I was not aware of any means by which the oxide of iron could be applied to the purification of gas from sulphurretted hydrogen. I was employed, a number of years ago, by Owen and Laming to experiment upon hydrated oxides. The anhydrous oxides will produce scarcely any perceptible effect upon gas; no practical benefit. It would separate the sulphuretted hydrogen from the coal gas; and it was to that effect I reported to Owen and Laming. When experiments are tried with hydrated oxide, the action is extremely apparent.

The LORD CHIEF BARON interposed by observing, that all this had been proved two hours back; and there had been no cross-examination upon it.

The witness was then asked, what would be the effect of roasting iron which had absorbed sulphuretted hydrogen? and he replied, that if anhydrous, it would remain such; if not, it would become such.

The LORD CHIEF BARON said: Professor Taylor stated the same thing two hours ago; and there had been no cross-examination on the point.

Examination resumed: I have examined the treatises on chemistry which have been referred to. According to my knowledge, Mr Hills' invention—the use of hydrated oxide of iron—was new at the date of his patent. I have read Mr. Croll's specification. The language he employs shows that he used the anhydrous oxides of iron. With regard to the sub-sulphate of and the oxychlorides, I agree with what has been stated.

Cross-examined by Sir F. THESIGER: My experiments for Laming and Owen were made about four or five years ago; I should say at least four years. They were made in order to ascertain whether the anhydrous oxide of iron could be used to purify coal gas; and I certified that it could not. Mr. Laming was present during the greater part of the experiments. I believe the native hydrated oxides will not purify. I have not tried them; but, from their compressed nature, I assume that. Supposing a native hydrate to be reduced to powder, you would give it a better chance of succeeding. I never tried the experiment.

Mr. HINDMARSH (in re-examination): You have read the plaintiff's specification; do you find anything in that specification——

Sir F. THESIGER objected that this did not arise out of the cross-examination.

Mr. HINDMARSH was going to complete his question by saying, "which would lead to the conclusion that the native oxide was intended to be used."

The LORD CHIEF BARON thought this did not arise out of the cross-examination.

Mr KNOWLES said it was clear that his learned friend was about to make an objection to the specification, founded on this native hydrated oxide.

The LORD CHIEF BARON: As far as I can judge, he would make any such attempt quite in vain.

Mr. KNOWLES would not, then, say any more about it.

Mr. *Dugald Campbell:* examined by Mr. KNOWLES.

I am analytical chemist to the Brompton Hospital. I have directed my inquiries to the subject of gas, and have made myself as well acquainted as I could with the various modes of improving gas which exist. In my opinion, at the date of the plaintiff's patent, his alleged invention was a new discovery.

Cross-examined by Sir F. THESIGER: I read Mr. Croll's patent about a month ago. I read Mr. Laming's about the same time. I knew of the patents some years ago; perhaps three or four.

Re-examined by Mr. KNOWLES: Notwithstanding these patents, the plaintiff's is a new invention.

The Rev. *Thomas Pelham Dale:* examined by Mr. KNOWLES.

I am a clergyman. I have given a great deal of attention to chemical science. In the autumn of 1849, and before, I assisted Mr. Hills in experiments in the process for purifying gas. It was at the time he was preparing to take out his patent, and even before the patent was on the *tapis*. The experiments were carried on at Mr. Hills' works at Deptford. The hydrated peroxide of iron was tried, and its results ascertained. It was some months before the patent.

Cross-examined by Sir F. THESIGER: It must have been some time in the year 1848. The peroxide of iron must have been tried some months before the patent was spoken of. The experiments were most various. One of them was, in effect, the very same that is now used in the gas-works. In the early part we experimented with impure gases, which we made ourselves, on a small scale. I used to make the gas impure first of all, in order to purify it. I saw experiments made, on a large scale, upon the hydrated peroxides, with gas drawn from the gas-works, after those experiments alluded to. I cannot recollect when this was—whether in 1849 or 1850. Mr. Thomas Hills, brother of the plaintiff, was present from time to time at these latter experiments.

Re-examined by Mr. KNOWLES: My experiments lasted over a considerable time; as early as 1848 decidedly the hydrated oxide of iron was tried.

Mr. *Barnard:* examined by Mr. KNOWLES.

I was for some years manager of the Deptford Gas Company's works. I left last September. I recollect the company furnishing Mr. Hills with gas for the purpose of experiments. I laid on a pipe for Mr. Hills' experiments. He had, first of all, a small purifier, where he tried it; afterwards we tried his purifying material through one of our purifiers. He was experimenting during the whole of 1848; but in the latter part of the year we tried it through one of our purifiers.

Cross-examined by Sir F. THESIGER: These large experiments lasted over two or three weeks, in our works, in the latter part of 1848. The pipe was first introduced in 1847, and then Mr. Hills tried it on his own premises. In 1848, I connected the pipe on our premises, and had the purifier fixed on the gas-works. This continued during the whole of 1848; and we used the purifier afterwards. We began using the materials as soon as Mr. Hills could supply us with them—the materials we purified our gas with, made from sawdust.

The LORD CHIEF BARON: When was that?—The latter part of 1850, or 1851; I will not be certain.

Cross-examination resumed: Between 1848 and the latter part of 1850, I merely allowed Mr. Hills to try his experiments. We did not use the material; neither were we in a position to use it. I believe we did not use the material till the latter part of 1850. I am no chemist; but the material was sawdust mixed with some material of a chocolate colour; I should suppose some species of iron. Application was made to me to use this material, before the latter end of 1850, at different times. General use was made of Mr. Hills' material almost as soon as he could supply us with it; it might be five or six months after.

Re-examined by Mr. KNOWLES: The experiment was made in 1848. The supply of gas, the communication between our yard and Mr. Hills' works, continued during the whole of 1849, as it had done in 1848, up to the time when we began using it. We had it on when I left the works.

Mr. *Thomas Hills:* examined by Mr. GROVE.

I am brother of the plaintiff. I recollect his experimenting in the years 1848 and 1849. He then used hydrated oxide. That was long before the date of the patent. He also tried experiments upon the renovating process before the date of the patent I went to the Westminster Gas-works in July, 1849, to superintend the putting of sawdust into the purifier, and taking out the ammonia from the gas. That was the patent of my brother. On that occasion, I saw Mr. Evans several times. He did not tell me anything about hydrated oxide. He did not mention any process for purifying from sulphuretted hydrogen. I saw no process of his there. I did not communicate to my brother anything as to any process of his referring to this patent.

The LORD CHIEF BARON remarked, that all this was mere negation; he did not know of what.

Mr. GROVE replied, that the plaintiff was asked, as to the question of prior invention, whether he had had a communication with Mr. Evans; and then whether he had had a communication with his brother, that brother having seen Evans; and the witness said he had not.

Cross-examined by Sir F. THESIGER: My brother's experiments at the Chartered Company's works began about the middle of July, 1849. We finished filling the purifier at the works about the end of July, and I think the experiments went on for about six or eight months afterwards. I attended there frequently for my brother. After I had been there some time, I saw Mr Laming with Mr. Evans (manager of the works), and then Mr. Evans told me that he was going to use Mr. Laming's patent for taking out the ammonia from the gas. I did not know that he was using the oxide of iron. I did not know that they were trying experiments when I was there.

A plan of the works was shown to the witness, who was asked whether a place pointed out was not the spot where the materials employed by Messrs. Laming and Evans in their experiments were thrown down?

Witness: I am sure I do not know; I never saw them. Mr. Evans once took me to another place, and he took off a cover to show me a purifier in which he had some super-phosphate of lime at the side of it. Some stuff had been laid down, of a grey colour, and that which lay at the side was very hard. I trod upon it to see whether I could break it, and I could not; and they said they could not use it, for it was super-phosphate of lime. Mr. Evans did not tell me that he had discovered a mode of revivifying the oxide of iron. My brother discovered this mode of revivifying either at the end of 1848, or the beginning of 1849; the experiments were going on from 1848 till the middle of 1849. At the Chartered Gas Company's works the materials we experimented upon were sawdust, with water sprinkled over it. That was what we proposed to the Chartered Gas Company to use. Immediately that the patent for it was finished, we proposed to them to use our oxide of iron. This was in 1851. I think there was a written application; but I am not certain. I do not think they refused it. It was left open to them. Some time afterwards, I heard that they were using it.

Re-examined by Mr. GROVE: They use it now. The only material that Mr. Evans ever showed me was the super-phosphate of lime. When I said that we proposed the other material soon after the patent, in 1851, I made a mistake; it was 1850. It was about April; it might be March; it was early.

Mr. KNOWLES: We have now done, my Lord, with that portion of the evidence, and will call a witness or two as to the infringement.

THE LORD CHIEF BARON: That is not denied.

Sir F. THESIGER: We will admit, for the purpose of this action, that we do use the plaintiff's invention.

The LORD CHIEF BARON: It is admitted that the defendants used hydrated peroxide of iron for purifying gas on the 28th and 29th days of June, 1856.

Mr. KNOWLES: That, my Lord, is the plaintiff's case.

Sir. F. THESIGER: Before I address the jury, I must make an application to your lordship for a nonsuit in this case; and the ground upon which I make the application is, that the invention, as stated in the specification, is not covered by the title. The original title, as specified in 1849, was "An improved mode of compressing peat for making fuel or gas, and of manufacturing gas, and of obtaining certain substances applicable to purifying the same." Now, by the disclaimer, the title was materially changed; and it is "An improved mode of manufacturing gas." Now, my Lord, there are three inventions which are stated in this specification, but it will only be necessary for me to call your attention to two of them, namely, the first and second, and perhaps they will be more clearly understood by reference to the claim. In page 15, your lordship will find the claim stated thus:—"Firstly, the purifying coal gas from sulphuretted hydrogen, cyanogen, and more or less perfectly from ammonia, by passing it through the precipitated or hydrated oxides of iron, or the subsulphates or oxychlorides of iron, from whatever source obtained." Then comes the second claim:—"Repeatedly renovating or re-oxidising the said purifying materials by the action of the air, whenever they from time to time cease to absorb sulphuretted hydrogen, so that they may be used over and over again to purify the gas.' Now, my Lord, that is not a mode of purifying the gas. This material may be treatedas the machine by which the gas is purified; and the second claim as a claim for repairing that machine when it gets out of repair, so as to enable them to use it again in the manufacture of gas; and, therefore, I say the title does not extend at all to this second invention. There is, however, my Lord, a case which is quite in point, which has reference to another patent of this kind, of "Croll *v.* Edge," in 9th "Common Bench Reports," page 479; and the observations made by Mr. Justice Maule in that case appear to me to be perfectly applicable to the present. What are the purifying materials, but the apparatus by which the gas is manufactured? It is not for improving the mode of manufacturing gas, but for repairing the machine when it is out of order, by reason of its having been applied previously to the manufacture of gas.

The LORD CHIEF BARON: It would fall, as it seems to me, very well within the old title.

Sir F. THESIGER: But that is disclaimed, and is now gone. The moment a disclaimer is filed, the specification must stand or fall upon the disclaimer; and the question here is, supposing this was the original specification, whether it is not apparent that this is merely a claim for repairing the machine when it is exhausted and worn out, by reason of its having been employed in the manufacture of gas, and not for an improved mode of manufacturing gas? I submit to your lordship, upon the authority of the case of "Croll *v.* Edge," that the patent is gone.

The LORD CHIEF BARON: It will be competent to you, Sir Frederick, to apply to the court on the subject, if you think there is anything in the point; but at present I do not think your objection sustainable; for it appears to me, that anything which contributes to the better manufacture of gas must be considered as part of the mode; and if, prior to the discovery, the gas contains sulphurretted hydrogen, and by the application of this process (whatever it may be) it contains less, or none at all, I should consider that an improved mode of manufacturing gas, and that it might be read thus:—"A mode of manufacturing improved gas." I think even that, if an alteration in the shape of the retort would have a beneficial effect upon the mode of manufacturing gas, that would be an improved mode; in short, I think anything, either in the materials used, the mode of using them, or the mode of renovating them, which would lead to making gas better, would be an improved mode of making gas. I cannot, for this purpose, distinguish between the materials and any part of the process; and if, at last, there comes out in the material to be burnt by the public something better than it was before, I think that that may well be described as "an improved mode of manufacturing gas."

Sir F. THESIGER: Your lordship will allow me to move the court.

The LORD CHIEF BARON: I cannot give you permission without Mr. Knowles' consent.

Mr. KNOWLES: Which, of course, my Lord, I do not withhold, at the same time, I wish to observe that, from the way in which the defendant has pleaded, the objection does not arise.

Sir F. THESIGER: That point, of course, will be open to my learned friend. Then, my Lord, I object to the specification, as uncertain in not giving the information which the public are entitled to have, and as throwing the public upon experiments for the purpose of ascertaining what materials could be used for the purpose of purifying gas. The claim is for the use of hydrated or precipitated oxides of iron, and for purifying coal gas from sulphuretted hodrogen. Now, my Lord, it appears that there are native hydrates and artificial hydrates, and we have it in evidence that there is this difference between the hydrated and precipitated oxides, that all the precipitated oxides are hydrated, but that some of the hydrated oxides are not precipitated; and we also have it in evidence that there are some of the hydrates and some of the precipitates which will not answer the purpose of purifying gas by themselves. It appears, however, from the specification, that the plaintiff claims all hydrated or precipitated oxides; therefore I submit that his claim is bad, as being too large, or he claims those hydrated or precipitated oxides which will not answer the purpose as well as those which will, and he has not explained which those are. Without experiments, which your lordship knows the public are not to be thrown upon, he has described no means by which to ascertain which are the hydrates and which are the precipitates that are applicable to the purpose. Upon this point there is the case of "Stevens *v.* Keating," in which, your lordship will recollect, there was a claim of all alkalies for the purpose of making a cement, and an objection was taken to the specification. It was proved that *all* alkalies would not answer the purpose, for there were some that certainly would not; and it was put by the court, in giving judgment, "Either you have claimed *all* alkalies—in which case your claim is too large, and there-

fore bad—or else, if you meant to confine your claim to those alkalies which will answer, you have not pointed out which they are." In this case, I submit it is equally clear that the plaintiff has either made his claim too large, or has not sufficiently specified; and in either point of view, upon the authority of "Stevens *v.* Keating," that this specification is bad.

The LORD CHIEF BARON: I think, Sir Frederick, that, as there is a point already reserved, this question upon the specification had better be reserved also.

Sir F. THESIGER: Very well, my Lord, the point will be reserved.

The LORD CHIEF BARON: Yes.

Sir F. THESIGER: May it please your lordship and gentlemen of the jury, I am sure it is unnecessary for me to apologise for having, in the performance of my duty, taken such objections as I thought were sustainable against the patent upon which the plaintiff is now proceeding; because it is always a matter of importance, where a person has obtained a patent by which he has the exclusive right to an invention for a certain term of years, that the public should be so far protected that, if he has no claim by reason of any merit in the invention, he should not be allowed to enjoy the monopoly conferred on him by the act of Parliament—and I do not use the term "monopoly" in an offensive sense. I quite agree with my learned friend in the observations which he made at the close of his speech, that it is very important indeed to protect patentees—not to allow any claim which they may have, arising out of a benefit which they have conferred on the public by their discoveries, to be interfered with; and that they ought to be considered in the light of benefactors where they have introduced an important invention for the benefit of the public. Gentlemen, you have heard that the act of Parliament requires that any person who obtains a patent shall, within a certain time, enrol his specification, which specification is to give to the public information as to the mode in which his invention is to be carried out, so clearly and distinct, that at the end of the term the public may know how they are to use and have the full benefit of the invention. If Mr. Hills should turn out in the result to be really entitled to the merit of being the inventor of this, which I admit to be a most important discovery, of course I could not for one moment dispute the claim it has to your attention. But I think there are circumstances in this case which will induce you to take a very different view of Mr. Hills' claim from that which was presented to you by my learned friend. It appears, no doubt, from the evidence which has been laid before you, that Mr. Hills is a gentleman of an ingenious, and perhaps I might say, a speculative turn; he has been engaged in a vast number of patents, and he has employed his inventive genius, undoubtedly, so far for the benefit of the public, combined with his own. What the merit of those different inventions may be, it is impossible for us to say; but, at all events, it is clear that he is a person who is alive to any opportunity which may present itself of occupying ground not previously taken up by any discoverer or inventor. Now, gentlemen, Mr. Hills says, "In the year 1849 I had discovered, and therefore was entitled to patent, a mode by which hydrated or precipitated oxides of iron might be applied to the purification of coal gas, by withdrawing from it the sulphuretted hydrogen; and I also made this important discovery (by which, of course, the process is very much economised), that the material which had been used, and which had been saturated with sulphuretted hydrogen, and so became incapable of further use, and which had been hitherto thrown away, just as the lime which had been previously employed for the same purpose, upon being exposed to external air became revivified, or reoxidised—had its original powers reimparted to it, and again became capable of performing the same important operation which it had done before." "Here, then (says my learned friend) I stand for Mr. Hills on his ground of merit." It was most important that some means should be discovered, superior to those that were then in existence, for the removal of the sulphuretted hydrogen; and it was most important, also, that this revivifying process should be introduced, because it enabled the parties to carry on the process in a much more economical manner. Now, then, let us see how far Mr. Hills' claim is well founded, not only upon the evidence that you have already before you, but upon that which I am prepared to offer. It seems, from Mr. Hills' evidence, that he had been, for a long time prior to 1849, making experiments, as they say, upon hydrated oxides of iron. I was particularly anxious to know from Mr. Dale—a highly respectable gentleman who was called before you, and who has a taste for chemical pursuits—what were the particular experiments which were made, and the time of making the experiments, which you will find will become most important in your consideration of this case. Mr. Dale, unfortunately, could not furnish us with that information, which would have been so useful; and the foreman at the Deptford Gas-works says, that, with regard to the experiments, they were made on a small scale, and that afterwards there was a pipe let in from the works. He does not know what the experiments were, but he says that the first occasion upon which Mr. Hills applied to that company for the purpose of supplying them with purifying material made of the hydrated oxide of iron, was at the latter end of the year 1850; that, although the application might have been made five or six months previously, yet the first use of the material as a purifier was at the latter end of the year 1850. Now, what had Mr. Hills been doing in the intervening time between the latter end of the year 1848 and the latter end of the year 1849, when he applied for his patent? It appears that in the month of July, 1849, he applied to the Chartered Gas Company to be allowed by them to make experiments in their works with these purifying materials. Now, what were the purifying materials that he employed at that time, for surely that is a circumstance very important to be considered? His witnesses say that he had been making his experiments upon the hydrated oxide of iron, but with a very great uncertainty (except with respect to Mr. Hills' brother) as to the time when those particular experiments commenced. But when he applied to the Chartered Gas Company to be allowed to experiment on their works, it was not for the purpose of trying the effect of these particular materials, which he afterwards patented, but it was for the purpose of trying water and sawdust—the "scrubber," as it is called—that is, a cascade of water being thrown on the gas—I believe distributed in small particles; that was the nature of the scrubber which he considered would be efficacious in purifying the gas of the sulphuretted hydrogen; and it is a circumstance worthy of your particular attention, that at that time, although Mr. Hills, as I understand his case, professes to have discovered the use of this hydrated oxide or peroxide of iron, there was no attempt whatever to make any experiments on that subject at the Chartered Gas Company's works. Well, but a circumstance was occurring there which becomes very important in the consideration of this case. Mr. Laming, who had applied for and obtained a patent in the year 1847, had, it appears, four or five years ago, been making experiments upon hydrates; but he was desirous of making experiments at the Chartered Gas Company's works. Permission was given to him, and he accordingly began, and stated what was the particular substance that he would employ; and, at the same time, he told Evans, the manager of the works, that he could use oxide of iron for the purpose of purifying the gas; upon which Evans asked him to use it, but he said "No, it was too expensive;" because he believed that it would be necessary to throw away the material after it had been employed in the purification of gas, just in the same way as lime had been thrown away after it had been used formerly for the same purpose. However, by the permission of Evans and by the permission of the Chartered Gas Company, Mr. Laming began his experiments, using muriate of iron, which was decomposed and converted into muriate of lime, and oxide of iron; and he tried his experiments upon a very large scale—as much as 1000 or 1200 feet per hour—being sufficient, I believe, to light a small town. These experiments were going on in the same place where Mr. Hills was making his experiments with water and sawdust; he was attending, and he had an opportunity of seeing, the experiments which were made on the oxide of iron. He had never at that time—certainly at the Chartered Gas Company's works—attempted any experiments on the oxide of iron; it was a discovery that was made by Mr. Laming: and the other discovery, to which I am about to call your attention, was also an accidental discovery, as some of the greatest discoveries which have benefited mankind have been. It happened that after the material which had been used by Mr. Laming had been rendered useless, and thrown down in a part of the premises, Evans went there the next day, and found that this material, which had been perfectly black when it was thrown away after use, had recovered its red colour which existed originally; and it immediately occurred to him that this might be used for the purpose of purifying the gas again; he tried the experiment—he found that it succeeded—he tried it again and again, and met with the same success; and Mr. Hills, according to what Evans will tell you, was informed by him of the discovery he had thus made. I understand that Mr. Evans will also say that he communicated the same thing to Mr. Hills' brother. Of course, here you will have a very painful task, as always happens where there are contradictions between witnesses, to decide on which side the truth lies; but that this discovery had been made by Mr. Evans in the way which I have stated, I think will appear from a communication that he made to the Chartered Gas Company upon the subject, on the 26th of January, 1850. Now, that undoubtedly is after the patent of Mr. Hills had been obtained, but before he had specified; so that nobody could know—until the month of May, 1850, when Mr. Hills specified—anything about his patent or his specification, except the mere title of the patent. I mention this in order that you may be satisfied that Mr. Evans is dealing fairly on this occasion with respect to the discovery which he had so accidentally made. He says, "I beg most respectfully to make the following report of Mr. Laming's mode of purifying coal gas, as practised here as an experiment for some time past. The material used consists of muriate of iron decomposed by lime, which forms muriate of lime and oxide of iron," &c. [The report was read.] Therefore, gentlemen, I think it is perfectly clear that, prior to the time of Mr. Hills applying for his patent, there had not only been publicly used, as I shall show you by witnesses, the oxide of iron for the purpose of purifying coal gas, which would deprive Mr. Hills altogether of his right to stand upon his patent at all, but also that this important discovery, on which so much reliance had been placed on the other side, was one that was made before Mr. Hills took out his patent, by other parties—made in an accidental manner, as Mr. Evans describes in his letter; and as to the *bonâ fides*, of which, I think, you can have no doubt whatever; because, how was Mr. Evans to know anything of Mr. Hills' supposed discovery with regard to this revivifying process, when, at the time the letter was written, he had not specified, and did not specify for five months afterwards? I think, therefore, that that is rather an important circumstance, and detracts from the high merit which my friend has claimed for Mr. Hills, as the inventor of this important process. Now let us see what occurs. Mr. Hills having tried his experiments at the Chartered Gas-works, and these experiments not being sufficiently useful in their result for the company to adopt them, he, in the month of November, 1849, applied to the Attorney-General for a patent. Now, since that time, the law with regard to the application to the law officer for a patent has been changed, for there was a new system introduced in the year 1852; but at that time it was an inflexible and invariable rule with the law officer to require from every person who came before him to apply for a patent, to set down in writing sufficient to inform the Attorney or Solicitor General of the nature of the patent for which he meant to apply; and the reason was this: it had been discovered that persons came before the law officers with a very general title, obtain their patent, and then included within the specification matters of which the law officer was not in the slightest degree aware, and of which he had no notion that he had granted a patent for.

The LORD CHIEF BARON: I remember a man being very angry with me because I would not allow him a patent with this title—"An improvement in locomotion," which would include everything from a walking-stick to a steam-engine.

Sir F. THESIGER: Your lordship will remember that there were several struggles with patentees to make them particularise more in the titles of their patents.

The LORD CHIEF BARON: The title of a patent might be so worded as to conceal entirely the nature of the invention. Are you aware what the title of the invention of the atmospheric railway was?

Sir F. THESIGER: No, my Lord.

The LORD CHIEF BARON: "An improvement in valves;" and that title was settled by Mr. Godson.

Sir F. THESIGER: Now, gentlemen, just conceive yourselves in the position of a person who professes to have made this extraordinary discovery, and who goes to the Attorney-General for the purpose of obtaining his sanction to a patent, in order to protect that discovery. He is required to deposit the papers containing the heads of his discovery. Mr. Hills has endeavoured to explain the extraordinary circumstance of that information being imperfect, from the circumstance of his not supposing that there was any deposit necessary; and the Attorney-General requiring that a deposit paper should be made, he put on the back of a letter the heads, which he copied on the deposit paper, as deposited with the Attorney-General. Why, if Mr. Hills was a poor, ignorant man, who had lighted on a valuable discovery, and was unacquainted with patents, we might have admitted that excuse: but he is a person engaged in no less than ten or twelve, and he knew what was the course that was expected to be pursued with regard to his application for a patent, and he must have known perfectly well what it was that he meant to apply for and insert in his specification. Now he says, "I had discovered, and I meant to patent, the use of hydrated oxide of iron." Just observe—not *all* oxides, but a particular description of oxide—hydrated oxide always. Where was the information to the Attorney-General that he was applying for a patent for the use of oxides at all, much less that he was applying for a patent for the use of a particular description of oxide, namely, hydrated or precipitated oxide? Now, the only part of his deposit paper, which he refers to as proof that he was applying for a particular subject matter of invention, is this: for absorbing sulphuretted hydrogen by passing the gas through sawdust, breeze, or peat charcoal in coarse powder,

or other porous bodies. Now, Dr. Taylor has told us, that long before this patent, the system had been perfectly well known, and practised, of passing gas through porous bodies for the purpose of purifying it from the sulphuretted hydrogen. Mr. Hills said that he differed with Dr. Taylor on that subject. I think Mr. Hills was a little bold, because, when I questioned him, he admitted that they had passed it through lime, and that lime is porous; and I should like to know how it was possible for the Attorney-General to have the slightest notion that there was any intention whatever to claim this, which, you will observe, is a particular specific limited grant of invention—one upon which Mr. Hills undertakes to stand and keep off the public—one which he says constitutes his distinct merit and his right to maintain this patent, and of which there is not the slightest hint to breathe in any particle of this deposit paper, which it was necessary should give the information. Again, I say there was no information at all given that he meant to apply also for revivifying the hydrated oxides of iron, after they had been used, by exposing them to the external air; for he says, "For absorbing sulphuretted hydrogen and renovating them again, either by heat or taking off the atmospheric pressure." Now, I say that there is nothing in this deposit paper which could give the least information to the Attorney-General of that which is clearly the important part, or one important part, of the invention of Mr. Hills—namely, the revivifying by means of the external air; because, although it is true that in his specification he does speak of removing the atmospheric pressure, that removal of the atmospheric pressure is for the purpose of increasing the force of the current of air which was to be driven through the exhausted material for the purpose of revivifying it. That, perhaps, is a matter entirely for his lordship.

The Lord Chief Baron: Whether this deposit paper is to have any effect, or whether the Attorney-General had the power of doing it, is a question for the court; and whether that binds the party depositing to take out a patent, which should not only be within the title, but within the title limited by this paper, is also a question for the court; and whether the specification, as it now stands, is within it or not, is, likewise, a question for the court, in which, at present, I had better say nothing.

Sir F. Thesiger: Your lordship remembers the case of "Hancock *v.* Ross"—the vulcanized india-rubber case—in which the same question arose?

The Lord Chief Baron: I do not recollect what the point was.

Sir F. Thesiger: There was a good deal of discussion in court with regard to their putting on the record a plea of this kind—pleading a deposit paper lodged with the Attorney-General, and the court would not allow the plea to be pleaded as to the deposit paper, but they allowed a plea which would permit the deposit paper to be put in evidence, for the purpose of establishing that it was a fraud.

The Lord Chief Baron: The court would not allow the plea, because that of itself was evidence.

Sir F. Thesiger: It is evidence that the party is not the first inventor; because, if, when it comes before the Attorney-General, he only claims a patent in respect of certain matters, and does not mention those which are afterwards in his specification, it is evidence to show that he was not the inventor at the time the patent was granted. Then there is the other plea, that the patent was not granted for the particular invention which he has afterwards specified; and in either point of view the fact becomes of great importance. These are questions of law which his lordship will have hereafter to consider; but the question of fact, and that he is not the first inventor, are important, his lordship will probably think, for your consideration. Now, gentlemen, the patent was granted in the month of November, 1849, and the parties, as you probably know, have six months to specify; that is, to inform the public, by enrolling the specification, of the mode in which the discovery is to be carried out. Mr. Hills took, as usual, the full benefit of the term, enrolling his specification on the last day, and he went on with it till the year 1850; but in the year 1853 a light suddenly broke in upon him, there having been various experiments made, as appears from the evidence, in the month of March or April, before the specification was enrolled. But I will pass that by. As I said before, in the year 1853 a new light broke in upon Mr. Hills, and he thought that the patent which he had obtained, and which was principally (for that was put in the van) "for an improved mode of compressing peat for making fuel and gas, and of manufacturing gas, and of obtaining certain substances applicable to purifying the same," could not be supported; and he applied, under the act of Parliamet, to disclaim certain portions of his patent, as not possessing the merit of novelty; and accordingly the specification upon the disclaimer in the year 1853, assumed a very different character—all with regard to peat was struck out—a new title was introduced—and, in fact, it was made almost completely new. At any rate, it was reduced very considerably in its dimensions, and at last it presented itself in the shape in which it appears before you, and must be supported on the footing that the specification, as it now stands, was the original specification.

The Lord Chief Baron: One of the objects of the law was to get rid of difficulties, and to relieve the patentee from any objection that might be made in point of form. It never was intended to allow the patentee, by that means, to enlarge his patent. I think he is still confined to those matters which were the subject of the original patent. Supposing, for instance, a man were to take out a patent for a new sort of retort in the manufacture of gas, and then were to disclaim the title in the specification, and to alter it to "an improvement in the manufacture of gas." I am not sure, notwithstanding the case you cite, that that would not still be a good patent, because an improvement in the manufacture of the retort used for the purpose of producing gas would be an improvement in the manufacture of gas. But at present I am clear that the plaintiff is still substantially confined to the title as it originally stood, and cannot go beyond the original scope of his invention.

Sir F. Thesiger: I was about to call your lordship's attention to the claims under the original patent, there being no less than nine heads of claim of invention, and in his disclaimer he cuts those claims down to three; he cuts off the head and tail of the title, and just leaves the middle of it as applicable to those reduced heads—to that Cerberus, that three-headed monster, which he has left by this process of reducing the amount of the claim in the manner I have described. Now, the disclaimer was obtained in the year 1853, before any action had been commenced by him against Owen or Laming, but not enrolled until the 27th of June, 1856. It is a very remarkable circumstance, that at this critical period Mr. Hills should wake up out of his long slumber, enrol his specification, and the very next day commence his action against the London Gas Company. The public were not at all aware of the alteration that had been made by this disclaimer; for three years, or nearly three years, they were kept in entire ignorance of it. However, he then thought that he had brought his specification into a shape which would be more available than the more extended view of it which he had originally presented, and proceeded with this action against the London Gas Company. Gentlemen, the London Gas Company, and all companies, and all individuals, are interested in opposing a person who claims a monopoly of this description, when he has no right whatever to exclude other persons from the use of it, by reason of his not being the original inventor: and therefore everything against a person who has conducted himself as Mr. Hills has done, must be considered to be fair and proper; and you yourselves will say whether my friend had a right to take the high tone for Mr. Hills which he assumed in his opening, and whether it is not clear that Mr. Hills had been anticipated, not only by those parties whom I have described, but also by a process and by a knowledge which existed at a time which I think would prevent a patent being taken out with reference to portions of this invention. Now, gentlemen, let us see what was the state of knowledge, and what had been done, prior to this time. In the year 1840 Mr. Croll had taken out a patent which endured for a period of fourteen years, and expired in the year 1854; and I say that, under that patent of Mr. Croll, there was distinct intimation given of a process precisely similar to that which was afterwards employed and patented by the plaintiff, and that Mr. Croll has anticipated the right of the plaintiff to claim the merit of the invention. Now that part of Mr. Croll's patent to which I wish to call your attention consists of two operations. The first operation is that of purifying the gas in a particular way, by means of certain salts, and removing the ammonia; and then, after the gas has been so partly purified, applying the second operation, namely, using among other things oxides of iron, for the purpose of removing the sulphuretted hydrogen.

The Lord Chief Baron: I did not observe till this moment in what manner the title had been altered. I have been looking about to see how that is stated, and I find that all the anterior part, "an improved mode of compressing peat for making fuel or gas, and of manufacturing gas, and of obtaining certain substances applicable to purifying the same," is entirely disclaimed.

Sir F. Thesiger: Quite, my Lord.

The Lord Chief Baron: An improved mode of compressing peat for making fuel or gas, is turned into "an improved mode of manufacturing gas."

Sir F. Thesiger: Yes, my Lord.

The Lord Chief Baron: I shall not stop the case now, but I am doubtful whether any one has a right so to disclaim. Probably your objection was pointed to that.

Sir F. Thesiger: It was, my Lord; but I have no doubt I did not express myself clearly; and, if you will do me the favour to recollect, I called your attention to the terms of the title as it originally stood.

The Lord Chief Baron: I reserve the point, of course. My attention was not directed to the title before, but I perceive that "and of obtaining certain substances applicable to purifying the same" is entirely struck out; and that part which related to squeezing peat is turned into making of gas.

Mr. Knowles: The original title was this: "An improved mode of compressing peat for making fuel or gas."

The Lord Chief Baron: That is merely a mode of compressing peat to make gas.

Mr Knowles: It is also an improved mode of manufacturing gas.

The Lord Chief Baron: It may be so.

Sir F. Thesiger: Now, gentlemen, I was about to call yonr attention to the two processes which are claimed by Mr. Croll: the first being the application of certain salts for the purpose of removing the ammonia; the second being an application of the partially purified gas to oxides of iron, among other things, in order to receive the sulphuretted hydrogen. Then he says, "The third part of my improvements in the manufacturing of coal gas consists in the application of the black oxide of manganese to remove or free coal gas of sulphuretted hydrogen, which is accomplished in the following manner:—"After the gas has been freed from ammonia as above described"—that is, the mode in which it is to be freed from ammonia—"it is then to be passed through a vessel similar to those now in use for the purification of coal gas by what is denominated dry lime, and charged in a similar manner with black oxide of manganese in powder, moistened with water to about the same consistency." Then he goes on to describe the mode in which it acts by absorbing sulphuretted hydrogen; and this is the part which my friends rely on as forming a distinction between Croll's and the plaintiff's. Mr. Croll thought he could adopt a mode of restoring the material to its former use, for he says—"This material, after it has ceased to absorb the sulphuretted hydrogen, is to be removed from the purifying-vessel, and roasted in an oven, to expel the sulphur which it then contains. After this material has become thoroughly red in the oven, I have found from two to three hours further time to be sufficient to accomplish this object, taking care that whilst it is being roasted it is well stirred about in the oven. After this operation is completed, the material is fit again to be employed, by being placed in the purifier, moistened with water, as in the first instance. The same effect may be produced by the application of the oxide of zinc and the oxides of iron, and treated precisely in the same way as above described." Now, I must entreat his lordship's attention to this passage, because, as I understand, it is that oxide of iron is to be treated in the way in which the oxide of manganese is to be treated for relieving coal gas of the sulphuretted hydrogen; and when that oxide has become completely saturated with sulphuretted hydrogen, the red heat is to be applied, not as my friends suppose, for this purpose, but for the purpose of removing that which impedes its operation, and prevents its acting in the way in which it is required—"the material is fit again to be employed by being placed in the purifier, moistened with water, as in the first instance." That is the way in which oxides of iron are to be treated; and he says in his claim, "I claim the purification of coal gas from ammonia, by means of chloride and sulphate of manganese, and muriate of iron, and sulphuric and muriatic acids; and the purification of gas from sulphuretted hydrogen, by means of the oxide of manganese, the oxide of iron, and the oxide of zinc, as hereinbefore mentioned and hereinbefore described, as applied in the particular manner and stage of the process of the manufacturing of coal gas hereinbefore mentioned, and not otherwise." Now, gentlemen, am I right in saying that this is the process of the plaintiff? Here are the two operations, which are clearly described in Mr. Croll's patent, which was in existence for fourteen years, it having expired in 1854. He points out that he uses oxides of iron, and that after oxides of iron have been used, and absorbed sulphuretted hydrogen, and therefore cannot be used again without undergoing some other process, he proposes to apply the process of heat; but with respect to the use of oxide of iron as a purifying process for getting rid of the sulphuretted hydrogen, there can be no doubt that Mr. Croll's patent conveyed distinct information to the plaintiff and the public as long ago as the year 1840, when the specification of Mr. Croll's patent was enrolled. Now, it may be—and I throw this out for your consideration—that my friends may say, but "oxides of iron" in Mr. Croll's patent is too wide, because it includes everything. The question is not whether Mr. Croll's patent would have stood the test of a trial, but whether the oxides of iron used for purifying gas, by removing the sulphuretted hydrogen, was not a fact communicated

to the public in the year 1840, and in the possession, therefore, of the plaintiff, as well as of the rest of the public? It will be proved, with respect to Mr. Croll, that he used his patent at the Chartered Gas Company's works in Brick Lane; and that he used "oxides," which is a general term, that would include hydrated and anhydrous—those which have water, and those which have no water; and that he actually employed this very substance long and long before the plaintiff took out his patent. Now, gentlemen, there is another circumstance with respect to the revivifying process which must not be passed over. We heard from one of the high scientific gentlemen, called on the part of the plaintiff, that it was perfectly well known as a principle, and had been done over and over again, that when hydrated oxide of iron had been brought into the state of sulphate of iron, and exposed to the air, it would be restored to its former state, and become hydrated oxide of iron again. Now, as I understand the question that was put upon that by my learned friend, it was, "But did you ever know that applied to the purifying of gas before?" The answer was, "No, I never did." But a very serious question will arise, and I think it has arisen before when his lordship has been trying patent cases, as to whether the mere application of a known substance to a new use can be at all the subject of a patent? It was perfectly well known that hydrated oxide of iron, when it had been charged or saturated with sulphuretted hydrogen and brought into the state of sulphate of iron, and exposed to the external air, would be brought back to the same state in which it was before. What useful invention can the plaintiff claim for having applied this knowledge to the purification of gas, oxide of iron having been applied to the purifying of gas before? The thing follows, as of course. If oxide of iron was applied to the purifying of gas, and if oxide of iron, which has been brought into an exhausted state, was recovered by exposure to air, then, of course, there is no merit in the application of that to the manufacture of gas; and I put it to his lordship's consideration whether, supposing it were new to apply this revivifying process to the purifying of gas, the mere turning it over to another use would be at all the subject of a patent? The claim itself is for the mere "renovating or re-oxidising the said purifying materials by the action of the air." It is not for applying it to the manufacture of gas, but for the thing itself; and I submit to his lordship that that is a claim for a thing which was perfectly well known. There is a familiar illustration of the view I have been submitting to his lordship in a case which has been handed to me by my learned friend, in which Lord Abinger says, "It would be a strange thing to allow a person to take out a patent for eating soup with a spoon, because some one had previously eaten peas with a spoon;" and that, no doubt, is a homely illustration of the view I was submitting. Now, gentlemen, there is another patent which has not been so particularly brought to your attention, namely, the patent of Mr. Laming in 1847, for "Certain improvements in manufacturing and purifying coal gas;" and it will appear that Mr. Laming proposed to use for the purpose of purifying this gas what he calls "carbonate of iron." Now, what is carbonate of iron? Dr. Taylor says that "carbonate of iron" is an incorrect expression; but that carbonate of iron was understood thirty years ago to mean hydrated oxide of iron. Well, then, if Mr. Laming proposes to use carbonate of iron for purifying gas in 1847, and carbonate of iron means hydrated oxide of iron, and would be so understood by everybody, what originality was there in the plaintiff's patent in the year 1849, which proposes to use hydrated oxide of iron? None whatever. Now, again, Mr. Laming proposed to mix together muriate of iron and lime for the purpose of this purification, and the result of that would be hydrated oxide of iron again. Mr. Laming proposes to precipitate the muriate or sulphate of iron by gas liquor, and to collect the product under the name of "carbonate of iron," being the hydrated oxide of iron. Mr. Hills in his patent tells us that he precipitates the same sorts of iron by the hydrosulphuret of ammonia, and the gas liquor consists essentially of the hydro-sulphuret of ammonia. Therefore we have in Mr. Laming's patent of 1847, even if we had not the patent of Mr. Croll, all that Mr. Hills can pretend to found his claim upon. Now, in the year 1850, Mr. Laming applied to the Attorney-General for a patent in respect (among other things) of the revivifying process I think his deposit paper consisted of various heads, and Evans joined him in that application for a patent. At that time Mr. Hills had not specified, but, according to our case, he had become acquainted with this revivifying process through the information he had received from Evans. Now, gentlemen, I will just describe to you, in order that you may understand the thing perfectly, the course of proceeding which took place in the Attorney-General's office at that time, when an application was made for a patent. Persons give notice of opposition. On the day appointed, the person claiming the patent went in alone to the room of the Attorney-General, and communicated to him privately the nature of the invention for which he sought his patent; he then left the room, and the persons opposing were called in, and asked what their invention was, the law officer taking care not to drop the slightest hint of any communication that had been made to him by the party applying for the patent. The parties then stated what their invention was, and the Attorney-General at once, in general, was able to pronounce that there was no interference at all, and that the party was entitled to his patent. But upon the present occasion, an application having been made by Laming and Evans for a patent for this revivifying process (among other things), Mr. Hills, who had got his patent, though he had not specified, came in and communicated to the Attorney-General what his revivifying process was which he proposed to use; and then the Attorney-General, who had no means of ascertaining how he obtained his knowledge, found that they had hit upon the same thing; and accordingly he struck out from Mr Laming's claim for his patent the claim of the revivifying process. Gentlemen, I know that I have trespassed at considerable length upon your attention, although I hope not beyond that degree which the importance of the case demanded. It is important to the plaintiff, because, if he can exclude the public from the use of his patent, he will enjoy a very valuable privilege; and, upon the other hand, it is important to the defendants, and to the public, because, if the plaintiff has not the merit of being the inventor, they are entitled to the use of his patent. Gentlemen, there is one observation that I ought to make with regard to something that was thrown out by the other side, as I understand the parties were in communication together. There was a reference which resulted in an agreement that the patent of each should be considered an available patent, and there was a certain distribution of the different companies among them. The London Gas Company had nothing to do with that, which would not in the slightest degree interfere with the question whether this patent is or is not a valid patent, by reason of those circumstances to which I have drawn your attention, and upon which I will call evidence to enable you to form your opinion.

Mr. HILL: We will consider both Croll's and Laming's patents as put in.

Mr. *Alexander Angus Croll* sworn: examined by Mr. HILLS.

I am a civil engineer, and for some considerable time have been connected, as a practical engineer, with the manufacture of gas. I obtained letters patent in the year 1840. I was the superintendent of the Chartered Gas Company in Brick Lane for, I think, about six years. I attempted to carry out the invention mentioned in my specification at their works, by means of oxide of iron. I used the oxide of iron obtained by having first passed impure gas, containing sulphuretted hydrogen through it in a wet-lime purifier, dissolving sulphate iron, first charging the wet-lime purifier with that, and passing the gas through it. That produced hydro-sulphuret of iron; that iron I used again as an oxide of iron in a dry-lime purifier, first having roasted that iron upon the top of the retort-beds. I have no doubt it was in a state of hydrated oxide of iron, but I did not examine it. One thing is certain, that I purified gas by means of oxide of iron obtained in that way over and over again. It was capable of purifying, and did purify, gas. I mixed the oxide of iron in the purifier with fine breeze. Breeze consists of the small of coke, and is a porous substance, more so than mere ashes. I do not exactly remember, but I should think I continued to use the oxide of iron, mixed with the porous substances, for purifying the gas for six or nine months during the year 1840. I did not purify the whole of the gas that was made; and, excepting that six or nine months, I have not used the oxide of iron until very lately, within the last two years, and then only occasionally, and to a small extent: I do not use it generally.

Cross-examined by Mr. KNOWLES: This was in 1840, at the Chartered Gas Company's works. Mr. Evans was then in the service of the company, not at Brick Lane, but at one of the stations at Westminster. I do not suppose, so far as that was concerned, that what was doing in Brick Lane was known at the Westminster station; it might have been. I did it for the purpose of gaining experience, in order to specify my patent. I specified in the patent the mode I adopted with the black oxide of manganese. I was certainly not aware that it was necessary to have hydrated oxide of iron at that time. I believe that is due to the accidental discovery of Mr. Evans. I knew I used an oxide of iron, which oxide of iron purified the gas. I was not aware it was hydrated. I think the heat I employed was not so high as that which has been mentioned. It was the waste heat from the top of the retort-beds, and I do not think it was so high as to expel the whole of the water. I have never been in any other position where I considered it advisable to use it. I believe wet lime is much cheaper, when carefully conducted, for the purpose of purification, than the manipulation required in working the oxide of iron. You may call it the "experimental" purifier in which I used it, so far as these works are concerned; but the quantity of gas could not be less than 18,000 cubic feet per day during the time I speak of. There were five, six, or seven retorts at that time, out of about 80. At any rate, a quantity of gas greater than the whole quantity made in the summer time at the Deptford works. I think it is very likely they were called the experimental purifiers. I put the purifiers up myself, and did it for the purpose of carrying out other experiments; but they were sufficiently large for any purpose. I have never in my life lectured upon the subject of gas. At the Institution of Civil Engineers I once read a paper on the purification of coal gas. It is very likely that that was in 1844—four years after my patent. It was a long paper, and I do not remember that there was anything in it pointing to the process I have mentioned with respect to the experimental purifiers. The object I had in view in reading that paper was the sale of sulphate of ammonia, which I produced in large quantities. My object being to insist upon the use of it for agricultural purposes, I incidentally gave a description of the mode of purifying gas, in reality for the purpose of creating a demand for sulphate of ammonia. I unquestionably had ammonia in my mind at the time of my patent, and it is decidedly the most valuable part of it. In my patent I point to the use of the black oxide of manganese. I should say that that is not an anhydrous oxide; but I am not sure. I cannot speak with certainty, for I have given very little attention to it since the time I specified. I did not give much attention to it, for I did not believe that there was much profit in the use of it. Until the outcry that has been raised against the nuisance arising from the manufacture of gas, I did not think it was worth using. There may be circumstances in which it is very valuable. I am connected with several gas companies, of which the Great Central is one. I erected the plant there I never took a licence from Mr. Hills for the use of his patent. To save time, I may say that I have got a licence; but that requires explanation. Some two or three years ago Mr. Owen and Mr. Laming called upon me, and said, "Mr. Hills and us have been infringing your patent for a great many years, and we wish to make an arrangement with you for the purchase of your patent." I agreed to dispose of my patent; and, having so agreed, I said, "If I wish to use the oxide of iron at any of the gas establishments that I may be connected with, you will let me have a licence, so that I may not be subjected to anything like a lawsuit. I have a licence to use Mr. Hills' patent, for which I pay nothing; nor do I use it any of the places. My own patent I sold to Owen and Co., one of the conditions of the sale being, that I should have the liberty of continuing to use the oxide of iron, either under Hills', my own, or Laming's patent. I can use it without paying anything. This document which has been handed to me is my agreement with Owen and Co., and this is the deed by which I assigned my patent. I did not examine the material after the purification. I only knew that the oxide of iron purified the gas.

By the LORD CHIEF BARON: What I mean is this—that, finding it answered the purpose of purifying the gas over again, I took it for granted that somehow or other it had been deprived of its sulphur.

By Mr. KNOWLES: I was not looking for ammonia, nor did I examine it minutely.

Re-examined by Sir F. THESIGER: I placed the material on the top of the beds of the retorts, where I obtained a heat of something like 400 degrees. At least 18,000 cubic feet of gas per day was purified, as far as I recollect. I think there was a larger quantity of gas than was made at one setting. This quantity continued to be purified during the six or nine months mentioned by me. After the gas was purified, it was distributed to the consumers. It was not a mere experiment, but it was purified and sent out through the gas-meter along with the rest. I assigned my patent to Laming and Owen, and upon that assignment the agreement was entered into that I should use the oxide of iron if I thought proper—that I should have the power of doing so. I have had the power since that time, but I have not, in fact, used it, although I have nothing to pay for it. I think lime is cheaper, when the ammonia is taken out previously by a metallic salt; but there may be circumstances in which the oxide of iron may be very valuable, in consequence of the position of the works.

Mr. *Redwood* sworn: examined by Mr. WEBSTER.

I am a chemist, of several years' experience. My attention has been called to the specifications of Mr. Croll, of 1840, of Mr. Laming, of 1847, and of Mr. Hills, of 1850. I observe that Mr. Croll, in his specification, uses oxide of iron. There are various oxides; and I consider that the oxides, in different states, are available for the purpose of purifying gas. Having regard to the expression, "oxides of iron," used in Mr. Croll's patent, I am un-

doubtedly of opinion that that includes what is contained in the specifications of Mr. Laming and Mr. Hills. I observe the expression used by Mr. Hills, in his specification, of "hydrated oxide." That would be included in the expression, "oxides of iron," contained in Mr. Croll's specification: in other words, the hydrated peroxide of iron is an oxide of iron. The term, "oxides of iron," is the most general term that could be used, comprising everything that could be specified as anhydrous oxides, hydrated oxides, protoxides, and peroxides. There are two descriptions of hydrated oxides of iron—first, those that are produced by precipitation, which may be distinguished as artificially produced hydrated oxides; and there are the natural hydrated oxides—minerals that are found in the earth. There are great varieties of each of these hydrates produced by artificial means, in some cases containing a larger quantity of water than in others. Both descriptions of oxides would not be available for purifying gas; for, according to my experiments, I think the natural hydrated oxides do not answer the purpose; but both are properly described as "hydrated oxides of iron." Mr. Laming, in his specification, I observe, uses the expression, "carbonate of iron." He also speaks of precipitating the muriate or sulphate of iron by gas liquor, and of collecting the produce under the name of carbonate of iron.

Cross-examined by Mr. GROVE: The oxide of manganese is anhydrous. I should say that, if the heat is not that of a full redness, that the hydrated oxide would not necessarily be rendered anhydrous. I have made experiments, in connexion with Mr. Lewis Thompson, on the subject, with a view of ascertaining whether the hydrated oxide can be brought into a state in which it can be still used availably for the purification of gas. The degree of heat of redness is given by Daniel at 900. Carbonate of iron is not sold in commerce. Under the name of "carbonate of iron," commercially, is understood hydrated peroxide of iron. Real carbonate of iron is not sold. Carbonates of manganese, lead, and zinc are sold, and can be kept; but carbonate of iron cannot exist in communication with the air, without undergoing decomposition in a very few minutes—it could only exist in a sealed tube. If you want it, there are chemists who will supply it to you; but it is not a matter of commerce. Carbonate of iron of commerce is hydrated peroxide of iron. There is a native carbonate of iron, which is well known. The word "oxides" is a general word, and if I saw it in a medical book I should judge, from the context, whether it meant hydrated or anhydrous, although I agree with Dr. Taylor, that they are different things.

Re-examined by Sir F. THESIGER: Looking at page 6 of Mr. Laming's patent, where he uses the words, "Carbonates of manganese, iron, zinc, and lead," I should judge by the context that he meant native carbonate of iron. He afterwards disclaims "manganese, zinc, and lead," and confines the process to iron, which I have tried, and have got by that process hydrated peroxide of iron.

Mr. *Warrington* sworn: examined by Sir F. THESIGER.

I am the manager of Apothecaries' Hall, and well acquainted with chemistry. I have made myself acquainted with the patents of Hills, Croll, and Laming. The term "carbonate of iron," as generally understood, means hydrated sesqui-oxide, inasmuch as in the Pharmacopœia it formerly went by the name of carbonate and sub-carbonate of iron; but, if you go into any chemist's shop and ask for carbonate of iron, you will get hydrated sesqui-oxide alone; which, if properly prepared according to the Pharmacopœia, is precipitated. I have tried the experiment, according to Mr. Laming's patent, of precipitating sulphate of iron. The precipitate passes down first of all as a mixed hydrated sulphate and carbonate of iron, and by exposure to air in the process of drying, becomes hydrated sesqui-oxide, which is used for the purpose of purifying gas, removing from it the sulphuretted hydrogen. The peroxide of the chemist is the sesqui-oxide of the Pharmacopœia—it is the same thing exactly.

Cross-examined by Mr. KNOWLES: I made experiments upon this subject within the last six months, I should say, and entirely with a view to this inquiry. I follow the description given of taking the ammoniacal liquor of the gas works, precipitating sulphate of iron with it, collecting that precipitate, and drying it by exposure to air; and that produces hydrated sesqui-oxide of iron. There is a little sulphur present; but, if the precipitate is washed sufficiently long, the sulphur is carried away before the drying operation commences. The drying operation is a very important operation; it exposes the precipitate to the atmosphere, and causes oxydation, which is the important part of it. If there is nothing as to that in the specification, it must be very faulty, because you cannot purify gas when sulphur is present. I see he says nothing about drying; and, unless you expose it to drying, you get carbonate of the protoxide of iron, which is the hydrated carbonate of the oxide.

Re-examined by Sir F. THESIGER: Any chemist who read this specification, and had to carry it out, I should imagine would understand that it must be dried. I cannot imagine that either Mr. Laming or any patentee would use it in the wet state. The precipitate would be a wet material, that could not be carried about except in buckets. Even if it were mixed with sawdust, I should say it would certainly require to be dried, in order to be moved about from place to place to be put in the purifiers. I do not see how the thing could be manipulated without being brought to a dry state.

Mr. *Lewis Thompson* sworn: examined by Mr. HILL.

I am a consulting chemist, and also a member of the College of Surgeons. My attention for a very long period has been called to the manufacture of gas. I have made myself well acquainted with the three patents which have been read. I have made many experiments with regard to the use of oxides of iron. I have made experiments under Croll's patent. I have used muriate of manganese to remove the ammonia from the gas, and afterwards employed the oxide of iron to purify it from the sulphuretted hydrogen, as described. I used the hydrated oxide of iron which I prepared myself. I have frequently sent to Apothecaries' Hall, and to several manufacturing chemists in different parts of London, for oxide of iron. I have repeatedly obtained some that would not purify gas. I had also joined in experiments made under Mr. Laming's patent; and, in following his specifi cation with respect to gas liquor acting on sulphate of iron, I have obtained sesqui-oxide of iron, which I have successfully used for the purification of gas.

Cross-examined by Mr. GROVE: I know that that is not mentioned in Mr. Laming's specification; but, inasmuch as he proposed to obtain the carbonate in an economical manner, it is necessary that he should preserve and collect the sulphate of ammonia. I cannot read his specification without seeing that that is his intention. Carbonate of iron, whether dried or not, would not exist in contact with the atmosphere. The length of time it would take to change, would depend on the quantity and the amount of surface exposed; if absorbed into sawdust, it would be an exceedingly rapid process. I know that Mr. Laming does not claim the exclusive use of a metallic oxide, but the combination of the oxide of manganese, iron, zinc, and lead, or either of them with other purifying matters; and that those other purifying matters are mentioned in his specification—chloride of calcium chiefly. I did not know that his invention was stated to be an improvement in the manner of using chloride of calcium for the purification of coal gas

Re-examined: Chloride of calcium would have no effect at all upon the oxide of iron; it is merely for the purpose of absorbing the ammonia; nor has the sulphuretted hydrogen of the gas.

By Sir F. THESIGER: With regard to my being present when Evans made the discovery of the revivifying process, I may mention that I called at the gas-works, for other purposes, towards the latter end of August, or the beginning of September, 1849, and saw Mr. Evans. He went over the works with me, and pointed out to me what he then said was a very remarkable discovery. I had previously been acquainted with the purification of gas by oxide of iron and breeze, and had been aware of the great expense. The moment I saw this, I said, "This is a most important thing; you should take out a patent for it." I left the works after he had shown it to me, merely taking with me a small portion of the material, which I analysed. My visit to the works must have been previously to the 7th September, 1849, because on that day I analysed it, and found it to consist of oxide of iron, muriate of lime, sulphate of lime, and sawdust. The material shown to me by Mr. Evans was of a light red colour. The time taken for the material to recover its colour and property, when thrown down, varies with the condition of the atmosphere, but generally from six to twenty-four hours: in cold weather it does not act so quickly.

By Mr. KNOWLES: This was in 1849. The note in my analytical book was made at the time (the 7th September), and enables me to give the date as the end of August or begining of September. That was the first time I had ever seen the revivification of oxide of iron. I advised Mr. Evans to take out a patent I subsequently had an opportunity of renewing my visits there.

It having been intimated that the examination of the next witness would occupy some considerable time, the further hearing of the case was adjourned until to-morrow.

WEDNESDAY, DEC. 3.

Mr. *Frederick John Evans* sworn: examined by Sir FREDERICK THESIGER.

You are the superintendent of the Chartered Gas Company's works?—I am.

And you superintend the chemical processes with regard to purifying gas and the general management?—I do.

Do you remember, in the year 1849, Mr. Laming applied to you to be allowed to try his process for the purification of gas?—I do.

Do you recollect when that application was made?—The first application was in June, 1849.

What was the substance used at that time in the experiments?—Muriate of lime.

Do you recollect the day on which those experiments first commenced?—Yes, I do; it was the 7th of June.

In the course of those experiments, did Mr. Laming say anything to you on the subject of purifying gas in any other manner?—He did.

What did he say?—He said he had a plan for purifying gas from sulphuretted hydrogen, by means of oxide of iron.

Did you ask him to try the experiment on oxide of iron?—I did.

What did he say?—He said it was too expensive to use.

Did he say why it was too expensive to use?—He said it was more expensive than lime. I do not know that he gave any reason why.

Was any application made to the company to allow him to make these experiments with oxide of iron?—Yes.

Have you got a letter of the 17th of July, 1849?—Yes [producing the same], addressed to the directors of the Chartered Gaslight and Coke Company.

I need not go particularly through this; but permission was given, and there is a minute of the board on the subject of Mr. Laming making these experiments?—Yes.

Now, what was the substance which was used? What were the materials used by Mr. Laming in those experiments?—It was muriate of iron decomposed by lime.

Producing in the result what?—Oxide of iron and muriate of lime.

The LORD CHIEF BARON: What sort of oxide of iron? There are different kinds.—This would be the precipitated or hydrated.

Are you a chemist?—I do not profess to be one, my Lord; I know a little of it.

Sir F. THESIGER: I believe you have been 20 years chemical manager of the Chartered Gas Company's works?—I have been with them longer than that.

The LORD CHIEF BARON: Do you know what process this was? because, if you can state that, there are many chemists who can tell us whether it was oxide of iron.—The material was not produced on the works; it was provided by Mr. Laming, and sent to the works.

How did you know it was hydrated or precipitated oxide of iron?—My knowledge of chemistry was sufficient to tell me that.

Just tell us by what indications you knew that, so that we may go along with you, and gentlemen who are well acquainted with chemistry may be able to test your knowledge?—At the time, I did not know this; I do not think we inquired whether it was hydrated or not; but since I have taken the subject more into consideration, and I have ascertained it by experiment.

Sir F. THESIGER: Probably I may get this very clearly by-and-by.

The LORD CHIEF BARON: I beg your pardon; assuming this to be proved to be oxide of iron, there is an end of the case.

Sir F. THESIGER: No doubt. That was the reason why I was anxious that we should have no doubt upon it. Your lordship will recollect that yesterday Mr. Thompson stated, a portion of the material was given to him, and he analysed it on the 7th of September, and he gave us the results of his analysis, and hydrated oxide of iron was one of those results.

The LORD CHIEF BACON: You mean Mr. Lewis Thompson, the last witness?

Sir F. THESIGER: Yes. When were these experiments?

Witness: On the 8th of August, 1849.

After the material had become saturated with sulphuretted hydrogen, what was done with it? Was it taken out of the purifier?—Mr. Laming sent enough to charge the purifier twice over, and he told me that when the first batch was saturated with sulphuretted hydrogen to take it out, throw it away, and begin the second batch.

Did you do so?—Yes.

Where did you throw the exhausted material, if I may use that expression?

The LORD CHIEF BARON: Saturated—not exhausted

Sir F. THESIGER: But exhausted of its purifying power.

Witness: I threw that down by the side of one of the gasholders, close to the purifier.

What was the colour of it when it was so thrown away?—Black.

Did you at any time afterwards use that material which had been so thrown out in a black colour?—I did the next morning.

Did it retain its black colour, or had it changed?—It had changed to red—nearly the same as it was originally.

Did you upon that make some experiments with any portion of it and same foul gas?—I did.

What was the effect on the material?—It blackened again.

Upon making this discovery, what did you do with regard to the material?—I thought it would very likely purify the gas again, and so I put it into the purifier.

The LORD CHIEF BARON: You found that it purified the gas as it had done before?—Just so.

Sir F. THESIGER: Did you go on using the material, then exposing it to the air, and then using it again?—Yes, for a number of times.

How often did the same material recover its purifying properties?—I think six times; the first experiment appears to have been on 386,770 cubic feet.

And afterwards there were experiments on the same large scale?—I should state that I had previously been drawing atmospheric air through lime into the purifier, for the purpose of deodorising and driving off the sulphuretted hydrogen; and I afterwards put up a pair of bellows, and blew the air through. I first ventilated the material in the purifier in October.

Before that, you had restored the property of the material merely by taking it out of the purifier and exposing it to the external air?—Just so.

And at this time, in October, you began the system of revivifying in the purifier by means of a current of air driven through?—Yes.

Now I believe, when you made the discovery of this change in the colour of the material, that it was applicable to purifying the gas again, Mr. Laming was not present?—He was not.

Did you inform Mr. Laming afterwards of what you had discovered?—I did.

Do you recollect whether it was the same day, or some days after the discovery was made?—Some days.

Were any observations made by Mr. Laming about it?—None whatever; nothing to lead me to think that he knew of it.

Can you tell us the quantity of gas altogether that you purified in this way by these experiments?—I should think 1,000,000 feet altogether.

That was, I suppose, sent out to the consumers?—Yes; it formed part of our ordinary work.

Now, you have mentioned this material and the change in it; do you recollect giving any portion of it to Mr. Thompson?—I do.

That is the material you have spoken of which changed its colour?—It is.

And which Mr. Laming brought on the premises?—Yes.

During the time this was going on, I believe Mr. Hills had been allowed to make experiments also on the Chartered Gas Company's works by his mode of purifying?—He had.

Can you give me the date?—On the 6th of July, 1849.

What was Mr. Hills' system of purification?—We had a vessel on the works, which we call a scrubber, about 10 feet in diameter, and 15 feet high; that was filled full of coke, and gas was allowed to pass through while a current of ammoniacal liquor was running through from the top. Mr. Hills proposed to take out the coke and fill it full of sawdust, and have a stream of clean water, which was allowed to run in at the top.

Mr. Hills did not propose to purify it by means of oxide of iron?—Not at all.

But by means of sawdust and water, in what you call the "scrubber?"—Yes.

Now, during the time of Mr. Hills' experiments, when I understand Mr. Laming's experiments were going on, were Mr. Hills and his brother frequently on the works?—Very frequently.

Did the experiments go on so near to each other that one might see what the other was doing?—Quite so; it was impossible for them not to have seen them.

Did you at any time communicate with Mr. Hills, or his brother, or both of them, the discovery that you had made of this revivifying process, as you call it?—I did. (Sensation.)

The LORD CHIEF BARON: To Mr. Hills and his brother?—Yes.

Sir F. THESIGER: Did you state to them at all how the discovery was made—whether accidentally or otherwise?—I told him the fact, that it was discovered accidentally.

Did you talk to them on the subject more than once?—It is very likely I might have mentioned it to them more than once.

How many times?—I cannot say. They had every opportunity of seeing it; I made no secret of the thing at all.

Down to what time did Mr. Hills' experiments continue?—They commenced in July and ended in October.

Just tell me this: during the greater part of the time that Mr. Hills' experiments were continuing, was the way of revivifying—drawing the material out in its black state, and its recovering its original colour—by means of the external air going on?—Yes.

You did not begin, as I understand, till October?—August.

Not to revivify in the purifier, by driving air through the material?—No.

The LORD CHIEF BARON: When was it that you began by exposing the material to the open air?—In August.

Was that done in the open yard?—Thrown down in a heap.

On the ground?—Yes.

That anybody might see it?—It was seen by hundreds.

Sir F. THESIGER (handing a plan to the witness): Look at this, and tell me whether it is a description of the works?—Yes.

Now, tell me where the material was thrown down?—On the part marked "C."

That was where Mr. Laming's experiments were going on?—Yes.

Just describe, on the same plan, where Mr. Hills' experiments were proceeding?—At a distance of 35 feet; about the distance from myself to the jury-box.

I believe you made a report to the Chartered Gas Company upon the subject of Mr. Laming's experiments in the month of January, 1850?—I did.

Have you got that report here?—Yes.

It was handed in and read by the Associate.

Gas Works, Horseferry Road, Jan. 26, 1850.

Gentlemen,—I beg most respectfully to make the following report on Mr. Laming's mode of purifying coal gas, as practised here as an experiment for some time past.

The material used consists of muriate of iron decomposed by lime, which forms muriate of lime and oxide of iron. This is mixed with water, and absorbed into sawdust, and put into the ordinary dry-lime purifier. The sulphur in the gas immediately combines with the oxide of iron, forming sulphuret of iron; the ammonia is at the same time taken out by means of the muriate of lime; the carbonate of ammonia in the gas effecting a double decomposition, part of the carbonic acid combining with the lime, and the muriatic acid with the ammonia.

The experiment was tried on the small scale, with the experimental purifiers, and was commenced on the 8th of August, 1849. It was found to remove the sulphur and ammonia most completely from the gas; but when the material was saturated, which it soon was, it was taken out, and fresh put in. If this had continued to have been the way of proceeding, it would have been quite a failure, on account of the expense; but it was observed, accidentally, that the material had the property of recovering its former purifying power by exposure to the atmosphere; and, on putting it into the purifier a second time, it purified the gas as well as the first time; and, on taking it out a second time, it was equally effective again. I then suggested to Mr. Laming that, instead of taking the material out of the purifier, it would be far more economical to draw air through the material while in the purifier. This was done, and the same material was used six times over again. The first time of drawing air through the material while in the purifier took place on Oct. 22, 1849.

Finding the experiment so successful on a small scale, I determined to try it on a larger one in the four purifiers erected for the Houses of Parliament. In this experiment I wished to ascertain whether the gas could be kept quite clean during the time one purifier was being ventilated. The purifiers were all charged, and three of them put into action on the 20th of December, 1849; but the result was so different to the former experiment, although the material was mixed in a similar manner, that I could not account for the difference. I therefore wrote to Mr. Laming, who came, but could not discover the reason; he said he thought it arose from all the ammonia having been previously taken out of the gas by Johnson's material; to this I reminded him that on the former experiment he said the material would act better if the ammonia was previously taken out. He then went away, and in a short time after he brought a gentleman named Thompson, who was formerly associated with him in Paris, and who has again joined him. This gentleman had made the greater part of the experiments for Mr. Laming; and when the thing was explained to him, he said he would make some experiments upon it, and let me know.

The next day they both came, and Mr. Thompson said he had discovered the cause of the material not performing its proper action, and that it was owing to the change in the weather, which had set in very cold; and he says that the material does not act so well in cold weather as in warm. Mr. Laming then suggested that during the cold weather the air should be warmed previous to its coming into contact with the material, and also the gas likewise. Here the matter rests. The material is still in the purifiers, and does its work very partially; in fact, it is now quite useless as a purifying material for the whole of the gas we make. What it may do, if the suggestions of Mr. Laming are carried into effect, I cannot say (although I think Mr. Thompson is right in his conjecture).

In order, however, to give the court some data to form an opinion of the advantage or otherwise of this process over our mode of purifying by means of lime, I will assume that the experiment had been perfectly successful, and compare the cost of the two, by which it will be seen, if Mr. Laming's plan was adopted on this occasion, it would occasion an additional outlay of £489. 10s., or ·294d. per 1000 feet over our present mode, which is simple, cheap, and effective.

I feel bound to admit that the plan, if successful, and putting cost out of the question, is a very simple and beautiful one, and has advantages over lime which would render its adoption desirable, as there is no smell during the process. But I must, at the same time, in justice to the company who allowed Mr. Laming to make his experiments on their works, and to myself, state, that when Mr. Laming mentioned his several plans for purification of gas to me, this one he said was too expensive, and would not do; and it was not until I requested some of the material to be sent, in order that I might try it, that the facts regarding the revivification of the material were accidentally discovered; and to the discovery of those facts, and to the suggestions given to Mr. Laming by myself respecting bringing the air in contact with the material while in the purifier, that the success of the first experiment is due, and which has completely altered the feature of the invention, as originally proposed by Mr. Laming.

I also discovered that the whole of the carbonic acid is not taken out by this mode of purification; therefore, the gas would have to be brought into contact with lime to render it quite pure (Mr. Laming, in his letter, states that no lime would be required), which, of course, would add to the expense of purification; but I have not added this expense to the estimate, as, I presume, Mr. Laming includes the abstraction of the carbonic acid from the gas as part of his offer of purification.

There is, however, an extra expense to which we should be subjected to if the plan was carried out, and that is, of providing some material to be used as luting for the retort-lids. At present, we use the refuse lime; but, as the material used by Mr. Laming is totally unfit for that purpose, either fresh lime or loam would have to be provided; this I estimate would cost, at least, £150 per annum.

Trusting, gentlemen, I have laid the whole of the facts relating to this experiment before you, I have the honour to remain, your obedient servant,

F. J. EVANS.

WESTMINSTER STATION.

STATEMENT OF THE TOTAL COST FOR PURIFICATION FOR ONE YEAR, ENDING DECEMBER, 1849.

Lime used—1484 yards, at 10s. 6d.	£779 2 0
Labour to do.	357 10 0
Cartage of refuse lime.	91 8 0
Expenses of ventilation	100 0 0
Total cost	£1328 0 0
Ammoniacal liquor sold for the year	357 10 0
	£970 10 0
If the ammoniacal liquor sold for the year had been in proportion to the quarter to Christmas, it would have realised £700, or £342. 10s. more than above stated	342 10 0
Total cost of purification, deducting value of liquor	£628 0 0

The gas made for the year was 400,000,000, which will give ·376d. per 1000 feet for purification.

COST BY MR. LAMING'S METHOD.

Mr. Laming requires 4¼d. for every ton of coals carbonised on the works: he finding, delivering, and taking away the material when saturated; and, in addition, he is to have all the gas liquor and ammonia contained in the gas. The company, however, to be at the expense of labour in charging and discharging the purifiers. This I estimate at half the expense of lime. Then—

Coals carbonised—42,059 tons at 4¼d.	£789 0 0
Labour in charging and discharging	178 10 0
Cost of luting for retort-lids	150 0 0
Total cost of purification	£1117 10 0

Gas made—400,000,000, or ·670d. per 1,000,000 feet, being £489. 10s. per annum more than at present—

Mr Laming's plan.	£1117 10 0	at ·670d. per 1,000,000 feet.	
Present plan	628 0 0	at ·376d.	do. do.
Difference in favour of the present plan	£489 10 0	at ·294d. per 1,000,000 feet.	

The LORD CHIEF BARON: I should like to ask some chemist whether that is not the very process which is now claimed by Mr. Hills.

Sir F. THESIGER: Mr. Thompson said yesterday that he had analysed this.

The LORD CHIEF BARON; His evidence did not apply to that report.

Sir F. THESIGER: Certainly not.

The LORD CHIEF BARON: I wanted to put it to Professor Taylor, or some other chemist, whether that is not the very process which the plaintiff is claiming a right to; and then the question would be, whether this was not a publication.

Sir F. THESIGER: We shall show the nature of this experiment, not merely by the evidence of Mr. Evans and Mr. Laming, but by a person of the name of Roberts, who saw the experiments.

Mr. KNOWLES: I should propose to call back some of the gentlemen by and by, because your lordship will remember I was not permitted to examine into the matter of this patent, because at that moment it was not in evidence. The report is dated after the patent.

The LORD CHIEF BARON: It is very true that your patent is the 29th of November. The importance of that paper is this, that, if it contains what

you claim as your discovery, then the question is, whether that is a faithful statement of what had been done in August and October; and then the question would be, again, whether that was done so publicly, and under such circumstances as to prevent another person from taking out a patent for it.

Mr. KNOWLES: That will be a question, no doubt, to be considered. Your lordship will hear something more about this.

The LORD CHIEF BARON: I am anxious to avoid all conflict of testimony, if one can avoid it; and all questions of personal veracity, if one can avoid that; because, if that report contains that which the plaintiff claims as his invention, then the inference from that is, that Laming and the witness were doing in August and October that for which the plaintiff took out his patent in November; and then the only question would be, whether the nature of what may be considered the operations of these gentlemen was such as to prevent a patent from being taken out. But there is, beyond that, another question, and that is, whether the report and the facts to which the report alludes do not distinctly show that Mr. Laming, who had a patent, was using the very hydrated oxide of iron which was described by the chemists yesterday. There was a doubt thrown upon it yesterday, with reference to the mode in which it was prepared; but no person of ordinary capacity can doubt that that is the substance; and I do not see how a patent taken out in November, 1849, can deprive Mr. Laming of the right to use his oxide of iron, which is clearly stated in his specification.

Mr. KNOWLES: Subject to a disclaimer of the particular mixture which is the foundation of Laming's patent, and which we do not claim to use.

The LORD CHIEF BARON: What mixture is that?

Mr. KNOWLES: It would be much more convenient if I had all my learned friend's evidence.

The LORD CHIEF BARON: He claims the purifying of gas by means of hydrated oxide of iron.

Mr. HINDMARSH: Alone, but not mixed with muriate of lime.

The LORD CHIEF BARON: This is what he says—"Either by themselves, or, which is much better, made into a more porous material by being absorbed into or mixed with sawdust or peat charcoal; and either used alone, or mixed with sulphate of lime or muriate of manganese, and in conjunction with any other purifying material.

Mr. HINDMARSH: Then there is an express disclaimer containing the peroxide of iron and the muriate of lime.

The LORD CHIEF BARON: He claims the hydrated oxide of iron.

Mr. HINDMARSH: Not mixed with chloride of calcium.

Mr. KNOWLES: That is the mode which is used and claimed in Laming's patent.

The LORD CHIEF BARON: Can you refer to the part of Laming's specification which you say distinguishes his from Hills'?

Mr. HINDMARSH: If your lordship will look at page 6 of the specification, you will see there is a passage which says that chloride of calcium is both abundant and cheap; and, under certain circumstances, it may be desirable to make it for the purpose of gas purifying by means of lime or chalk; and in such cases, the oxides or carbonates which result are useful for purification, and need not be removed. And then he says, "I don't claim either of these processes, but I claim the application of mixtures so made to the purification of coal gas."

The LORD CHIEF BARON: Let me call your attention to this: he says—"Another part of my invention consists in the use of carbonates of iron for the purification of coal gas." There is nothing about mixing it with calcium or anything else. He claims the use of carbonate of iron for the purification of coal gas.

Mr. KNOWLES: If "carbonate of iron" there is to be taken in the sense in which my learned friend put it; not as proper carbonate, but as the carbonate prepared and sold in chemists' shops. This is, in effect, a disclaimer.

The LORD CHIEF BARON: Where is the disclaimer?

Mr. KNOWLES: At the bottom of page 7. "I do not claim the exclusive use of any metallic oxide for the purification of coal gas."

The LORD CHIEF BARON: No; but he had pointed it out. It is not because a man does not claim it that anybody else may take out a patent for what he does not claim. He does not claim it alone; that is all.

Sir F. THESIGER: Mr. Evans, I see in this report of yours you give a comparative estimate of the different particulars of the processes with lime and oxide of iron?—I do.

And you gave the preference, in point of cheapness, to the lime?—At that time.

I believe in purifying gas there are three substances necessary to be removed—ammonia, sulphuretted hydrogen, and carbonic acid?—Yes.

The LORD CHIEF BARON: It is my opinion this second part cannot be sustained, supposing the carbonate of iron described by Mr. Laming is the same substance which is called by Professor Taylor hydrated oxide of iron.

Mr. KNOWLES: I am quite sure, when your lordship comes to see what is claimed here, you will find that no chemist's mind would ever be turned to the production of hydrated oxide of iron by the process that is mentioned here.

The LORD CHIEF BARON: Mr. Knowles, it is a matter of perfect indifference whether that process would lead to it or not. He had spoken of carbonate of iron, and there can be no doubt that he meant the carbonate of iron of commerce.

Mr. KNOWLES: I should say there is a very great deal; because he uses the words "carbonate of iron," with the carbonate of zinc and the carbonate of lead, which are proper carbonates; and no one reading these words together would suppose that the carbonate he alluded to was a proper carbonate as it is in the instance of manganese, zinc, and lead.

The LORD CHIEF BARON: I come to a totally different conclusion.

Mr. KNOWLES: Your lordship will find that, if the carbonate of iron mentioned here is to be taken in the sense they apply to it, it would be an article that could not be used, because it is a preparation made in a particular way, which would be much too expensive for use.

The LORD CHIEF BARON: You mean the real carbonate of iron.

Mr. KNOWLES: I mean the carbonate of iron as it is both called and sold by chemists—hydrated peroxide, which you would get, according to the evidence of some of the witnesses, by going to a chemist's shop and asking for carbonate of iron. I should wish to give your lordship some further evidence upon that.

The LORD CHIEF BARON: He has since disclaimed.

Mr. KNOWLES: After our patent.

The LORD CHIEF BARON: That cannot make your patent good.

Mr. KNOWLES: We must take it as he originally put it.

The LORD CHIEF BARON: I beg your pardon.

Mr. KNOWLES: He disclaims after his disputes with us begin; then he strikes out manganese, zinc, and lead, and leaves iron alone.

The LORD CHIEF BARON: I have thrown out an opinion which has grown upon me the whole of yesterday, and which has satisfied me that you cannot succeed. If you choose to fail on those parts of your case, which I was desirous, if possible, to avoid trying, be it so; go on.

Mr. KNOWLES: Your lordship rules that this patent is fatal to our patent.

The LORD CHIEF BARON: I am of opinion that the patent of Laming is fatal to your patent; that the substance which was used by him was peroxide of iron; and the evidence, coupled with the report, which no one can possibly now doubt, makes it perfectly certain that the material which was used was hydrated peroxide of iron. That being so, I am certainly of opinion, in point of law, that the patent of the plaintiff cannot be sustained.

Mr. KNOWLES: What I am desirous of ascertaining is this:—If your lordship rules merely on a comparison of the two patents, of course I have nothing to do but to submit to that ruling.

The LORD CHIEF BARON: I would add this also, not merely on a comparison of the patents, but that the substance which is referred to in Laming's patent was really and truly peroxide or sesquioxide of iron; and about that, I believe, there is no more doubt than that it is now past ten o'clock.

Mr. KNOWLES: If I am to understand that, upon a comparison of the patents, your lordship thinks that the alleged invention in our patent is shown here, of course I have nothing to do but to submit to your lordship's ruling; but, if your lordship proceeds on this patent, as explained by the evidence, I should beg leave to give other evidence to further the explanation. If your lordship further proceeds on the report, and the experiments leading to that report, I should have an observation to make. It was experiment at the beginning—it ended in experiment; and there are various reasons which your lordship would become acquainted with when I cross-examined the gentlemen, which would probably bring you to a different conclusion.

The LORD CHIEF BARON: I am of opinion that, in point of law, the patent of Laming, with the evidence of Professor Taylor (if there was no other evidence), which I may take certainly as against the plaintiff to have been proved, makes your patent void.

Mr. KNOWLES: Professor Taylor was not examined in reference to Laming's patent.

The LORD CHIEF BARON: I do not want the opinion of any one as to that patent; I merely wanted the opinion of Professor Taylor that the carbonate of iron of commerce was the hydrated peroxide or sesquioxide of iron. That is now abundantly and conclusively proved by the report of what was done in October. I speak of that only as satisfying my own mind; but I am perfectly satisfied without it. I am of opinion that your patent cannot be sustained. I was certainly very anxious, if possible, to avoid entering into other matters.

Mr. KNOWLES: I am very anxious to save time; and, if I am to be nonsuited on the patent, I submit; but, if your lordship is to proceed on public user——

The LORD CHIEF BARON: I do not proceed on that.

Mr. KNOWLES: They were nothing but experiments, and I am quite certain I could satisfy the jury.

The LORD CHIEF BARON: The statement of Professor Taylor was, that the carbonate of iron of commerce was hydrated peroxide of iron.

Mr. KNOWLES: Would your lordship allow me to recall Professor Taylor, and let him be examined more particularly? because, when the question was put by my learned friend, we were not directed to any part of Laming's patent; nor did we know the bearing of the question at the time. Perhaps your lordship would allow me to ask Professor Taylor a few questions?

The LORD CHIEF BARON: What is the question you want to put?

Mr. KNOWLES: I should ask him further with regard to the nature of these different carbonates.

The LORD CHIEF BARON: Certainly not; it has nothing to do with it; because the carbonate of manganese is a real carbonate, and the carbonate of lead is a real carbonate, it does not follow that the carbonate of iron should not be.

Mr. KNOWLES: There are other points upon which I should examine him.

The LORD CHIEF BARON: I shall not allow him to be called again.

Mr. KNOWLES: I should ask him more particularly about the carbonate of iron, and about the mixture that is mentioned.

The LORD CHIEF BARON: I do not think that is at all important.

Mr. KNOWLES: Does not your lordship think that, now that we know the sense in which my learned friends apply the word carbonate, we should call the gentleman on whose evidence your lordship so much relies?

The LORD CHIEF BARON: Certainly not; I said yesterday that nothing could be more clear, and explicit, and candid, than the statement of Professor Taylor.

Mr. KNOWLES: Your lordship will bear in mind that I was not permitted to examine into Laming's patent because it was not then in evidence; and it was distinctly said, when it was put in evidence I might call witnesses. My examination of Professor Taylor, not knowing the bearing of the question put by my learned friend, was not so full as it would have been if the question had been pointed to Laming's patent.

The LORD CHIEF BARON: I do not intend to permit Professor Taylor to be called again.

Mr. KNOWLES: I suppose, if I could not call Professor Taylor, I could not call any independent witness?

The LORD CHIEF BARON: I think Professor Taylor has stated that which fully justifies me in saying that the meaning of the word now is plain; and that being so, I think the first patent prevents the second being a good one.

Mr. KNOWLES: I merely wish to put myself in a position that, if upon consideration it appears right to do so, I can bring the matter again before the court. Now, my lord, might it not be material to ascertain from this witness whether the use of carbonate of iron was ever practised by him or by any body?

The LORD CHIEF BARON: Utterly unimportant.

Mr. KNOWLES: Whether it would ever produce the effect which we point out in our patent?

The LORD CHIEF BARON: I think not.

Mr. KNOWLES: It is my duty to submit to your lordship's view of the case.

The LORD CHIEF BARON: If you like to tender a bill of exceptions, you can.

Mr. KNOWLES: That is the course I would respectfully beg to take.

The LORD CHIEF BARON: You tender a bill of exceptions?

Mr. KNOWLES: Yes.

It was finally agreed that the plaintiff should be nonsuited.

Miscellaneous News.

THE METROPOLITAN BOARD OF WORKS.

TUESDAY, NOV. 25.

An Adjourned Meeting of the Board was held this day in the Council Chamber, Guildhall, to resume the discussion of the Financial Statement submitted by the Finance Committee on the 3rd ult., and for other purposes—Mr. THWAITES in the chair.

The minutes having been read and approved,

Mr. IRVINE introduced a deputation from the parish of Camberwell to present a memorial on the subject of the proposed assessment by this board.

The CLERK read the memorial, which stated that it appeared by the financial statement published by the board, that large sums of money had been borrowed for the purpose of improving the drainage under the Surrey and Kent Commission, extending from the Ravensborne to the Wandle river; and the memorialists could not find that any portion of those sums had been applied to the improvement of Camberwell, although the adjoining parishes had been greatly benefited. They therefore prayed that, before issuing the precepts for collecting the rates, an account should be furnished to them showing the manner of the expenditure of that money.

In support of the memorial, one member of the deputation was heard. He said the parish had never hesitated to meet the charges made upon them; and what they now desired was, that an opportunity might be afforded them to investigate the accounts, because they believed they could show that, although the drainage of their locality was in a most lamentable state, they had already contributed very largely to the cost of sewerage works in the Surrey and Kent district, from which they derived no benefit whatever.

The CHAIRMAN said, all the information in the possession of the board was at the service of the ratepayers of the metropolis; and, without troubling themselves to send up a deputation, the parishes and districts might investigate the accounts for themselves. But it must be remembered that this board succeeded to a state of things over which they had no control; they found that a certain expenditure had been incurred, and distributed over certain districts by the late commissioners; and it was a serious legal question whether this board had the power to reopen such matters. This applied not only to the district represented by the present applicants, but to others where it was felt that the full benefit of the expenditure had not been received. The late commissioners did not recognise separate parishes, but certain districts, or water-sheds and levels, as the area of taxation; and all the sewers constructed within such districts or water-sheds were made a charge upon the whole, although some portions might not have received an equal benefit with the rest. The board, therefore, had no separate accounts of the amount expended in Camberwell.

Mr. IRVINE moved the adoption of the memorial, which was seconded by Mr. D'IFFANGER.

The CHAIRMAN said that, if the motion were carried, it would occupy the present staff of clerks in the office something like twelve months to prepare the necessary returns, at a cost of perhaps £1400 or £1500; and even then the information supplied could not possibly embrace all the information sought, for the reasons he had stated. It would be a shorter and less expensive course for the parish of Camberwell to send a small deputation to the offices of the board, in order to examine the books and papers for themselves. But, even if the fact could be made out by such an investigation that the parish was called on for more money than had been expended in it, no practical result could ensue, as the board had no power to alter the state of things to which they succeeded.

The motion, after a brief conversation, was put and negatived.

FINANCIAL STATEMENT.

Mr. TURNER proceeded to submit the financial statement laid before the board on the 3rd of October, which showed the condition of the several parishes and districts in the metropolis, with the particulars of outstanding loans and mortgages, and furnished an estimate of the sums required to be raised by the board for the year ending Dec. 31, 1856. In doing this, he said it must be obvious to every member that this subject was one of the most important that could be brought under their consideration. It was most desirable that, before they proceeded to tax the ratepayers, they should take every possible means to tax them justly, and in proportion to the relative value of the property in the different parts of the metropolis. With regard to the mode of assessing the value, the board was no doubt precluded by the act of Parliament from dealing with the greater portion of the area of the metropolis, because by that act it was expressly stated that, where a county rate existed, they must take that rate as the ground of assessment. Still there was a large amount of property within the metropolitan area which was not subject to any county rate at all. With regard to that portion of property, the act told the board that they must tax it "upon a like estimate;" and the question they had to consider was, what a "like estimate" meant. The great bulk of the property not subject to a county rate was represented by the City of London. There were, in addition, smaller portions, such as the inns of court, Furnival's Inn, &c., not subject to county rate; therefore the practical question was whether the board had taken every means in their power to assess the City of London and these places upon a "like estimate" as the rest of the metropolis. When this question was discussed on a former occasion, it was contended that the board had not taken all the means in their power to determine at what sum the City of London ought to be assessed; and that, in order to avoid an inequality of assessment, instead of taking for their criterion a local tax, such as the sewers' rate, they ought to have taken the income-tax, which was not a local tax, but one superintended by an external authority, and in all districts and places managed upon one general principle. Such had been the criterion taken to avoid any inequalities, as between the parishes of Marylebone, St. Pancras, and St. George, Hanover Square; and he would assert that the principle which was good as between one parish and another, was good also as between Middlesex and the City of London. Just as they were not willing to take a local assessment of Marylebone, St. Pancras, or St. George's, Hanover Square, so ought they not to be satisfied with a local assessment of the City of London. The property-tax was common to the City of London and all the other districts in the metropolitan area; and, as it was necessary for the purpose of a uniform system of taxation that there should be one general standard of estimate, none better than the property-tax could be suggested. He therefore proposed—first, that the board should adopt a general principle, and afterwards decide in what manner that principle should be worked out—whether by itself or by committee. It was not necessary for the purpose of his argument to prove either that the sum at which the City was assessed was an adequate or an inadequate sum. There was no evidence that it was a just amount; and before the public would be satisfied that the City was estimated at a proper amount, it must be shown that they had gone upon the same principle as had been applied to the other districts in ascertaining that amount. There was this difference between the assessment on the sewers' rate and the property-tax, that the former was arrived at by the local surveyor, who ascertained the value of the property as well as he could, whereas the latter was the result of returns made by the occupiers themselves, who stated the amount of rent actually paid. To justify their proceeding, therefore, it was necessary the board should inspect the property-tax returns, which enabled them to ascertain whether any and what inequality existed. This was not entirely a matter of speculation, for, on referring to a return made to Parliament in 1855, he found the property-tax for the City of London was £1,584,351. This sum, however, included the inns of court, which were not included by the valuation of the board, and therefore a sum of £106,184 would have to be deducted. The sum then assessed to the property-tax in the City of London, after making that deduction, would be £1,478,167, excluding the inns of court. The sum put down in the financial statement was £1,153,069, making a difference between the property-tax assessment and the assessment by the Metropolitan Board of £325,098. This difference between the two assessments was 22 per cent. He had deduced from the printed tables the difference between the property-tax assessment and the county-rate assessment on property in the other parts of Middlesex out of the City, and he found it to be 16¼ per cent.—that was to say, the sum at which they proposed to assess the City of London was 22 per cent. below the assessment of the property-tax, while the sum at which they proposed to assess the other parts of Middlesex was only 16¼ per cent. under the property-tax. If these calculations were correct, they were in favour of the City of London from 5¾ to 6 per cent. That was a matter which ought to be inquired into. If the assessment of the City of London were made equal to the average assessment of the rest of Middlesex, £85,000 ought to be added to the amount of the estimate. He had thus shown ground for reference and inquiry. He was sorry his motion should be opposed by the representatives of the City, because he was only anxious to carry out the principle they themselves professed to be desirous of carrying out—namely, an equality of taxation. He would therefore move, "That, in order that the City of London may be assessed for the purposes of the Metropolis Local Management Act upon a like estimate with the rest of the metropolis, it is requisite that regard should be had to the amount at which the City of London has been assessed for the purposes of the property-tax."

Mr. SAVAGE seconded the motion.

Mr. DALTON said, when this question was referred to the finance committee, they, acting on the advice of the clerk, took the county rate where there was one, and the sewers' rate for the City of London, as being a like rate. On the report and financial statement coming before the board, it was objected that the latter estimate was too low, and that it ought to be framed on the property-tax returns. On that occasion, however, it was stated that those returns were not procurable. Subsequently to that the contrary had been ascertained; and it being Mr. Woolrych's opinion that it was competent to the board to adopt them as the basis of their assessment, where no county-rate existed, he should vote for the reference.

Deputy HARRISON contended that the decision of the board on the former occasion precluded further discussion on this point.

The CHAIRMAN overruled the objection.

Deputy HARRISON then said, he did not think the motion would effect the object the honourable member had in view, namely, an equality of taxation throughout the whole of the metropolitan districts. He would not discuss the legal question whether the board could or could not base the assessment of the rateable value of the City of London upon the returns made to the Property-Tax Commissioners; but it would be unfair if he did not state to the board that that question had been raised, and a legal opinion taken upon it, which opinion was to the effect that the board had no such power. Mr. Turner had stated that the rateable value returned for the City of London was, according to a parliamentary return, 22 per cent. under the value as fixed by the Property-Tax Commissioners. Now, he was prepared to say that, if all the districts within the metropolitan area were assessed upon the property-tax returns, he was the last man to oppose it. On examining the estimate of value of the different districts, it would be found that nothing like such a basis had been adopted; and he would briefly show the injustice of applying the property-tax standard exclusively to the City of London. By the parliamentary return, it was clearly shown that Hampstead, the district represented by Mr. Turner, was assessed at 23 per cent. under its proper value, the City being only assessed at 22 per cent. under its value. Marylebone, on the other hand, was charged so high, that the estimate was only 14 per cent. under its proper value. St. Pancras was still higher estimated, it being only 12½ per cent. below this parliamentary standard; and Lambeth was 22½ below the standard, while the City was only 22. If, therefore, the board would adopt this criterion of value generally to all the districts alike, he would agree to it with readiness, but he could not consent to make the City of London an exception. He would just mention the discrepancies that existed in regard to other parishes. St. George's, Hanover Square, was estimated at 18 per cent. under the value assigned to it by the property-tax return; Islington, 21 per cent.; Shoreditch, 24 per cent.; Paddington, 21 per cent.; Bethnal Green, 18½ per cent.; Newington, 20 per cent.; Camberwell, 17½ per cent. Thus it appeared that the county rate afforded a most variable criterion of value when compared with the property-tax returns; and yet, because the City of London happened to have no county rate, it was proposed to assess it up to the full amount of the property-tax return. The board never could adopt such a course. The sewers' rate had been taken as the ground of assessment for the City instead of a county rate, the City not having any such rate. Surveyors had been appointed by the corporation, who were bound to make that rate an equitable one; and the best mode for arriving at an accurate estimate had been adopted. There would be, in a few weeks, a new rate made for the City of London, and it might, therefore, be necessary to postpone this question till that took place. Meanwhile, all he asked was justice. He sought no favour, but he could not consent to apply a principle to the City of London which was not applied generally to the other districts of the metropolis. If Parliament had intended to ascertain the rateable value by means of the property-tax returns, nothing would have been more easy than for it to have been declared in the act itself. But it stated that, where there was no county rate, you should take a like rate; and in this case you had a like rate.

Mr. WRIGHT said, the words in the act were, "a like estimate," and not "a like rate."

Mr. HOWS said, the act of Parliament had clearly made an exception in the case of the City, and he should therefore call upon the board to adopt the same course.

Mr. LESLIE said, as the question now stood, it was in a very disagreeable form, and appeared to raise a contest between the City and the other parts of the metropolis; whereas he believed the board were only anxious to arrive at a just and equitable mode of assessing the entire area within their jurisdiction. The return which the worthy deputy had quoted from exhibited some strange discrepancies, and he could not take it as reliable. For instance, it

stated that the number of houses in the City was only 7297, although it was manifest there must be nearly double that number.

Mr. TURNER: There are upwards of 14,500.

Mr. LESLIE said, in that case, the rental, which on the 7297, according to this return, was £1,586,351, might, on inquiry, turn out to be double also. Certainly here was ground for inquiry. In other places, too—the Surrey and Kent portions of the metropolitan district—the magistrates were about making a new assessment, which might differ materially from the existing one. Such being the case, he thought the board were not as yet possessed of sufficient information to decide the question before them. It was not a question of the City only, but of several metropolitan parishes; and he should not be surprised, when all the facts were elicited, if the rental of the property liable to taxation proved to be £15,000,000, instead of £11,000,000 as at present.

Mr. DOULTON objected to any further delay, as it would necessitate a call being made upon the parishes for two or three rates at the same time. All that the honourable member for Hampstead asked was, not that the board should base their calculations upon the property-tax returns, but that the sum assessed upon the City of London should bear the same proportion to the property-tax that the sums assessed upon the other districts and parishes did.

Deputy HARRISON said he was quite willing to agree to such a proposal.

Mr. DOULTON: The honourable member said, "Do not make the City an exception," but he (Mr. Doulton) believed that if the board adopted col. 1, as prepared by the committee, the City would really be placed at such an advantage.

Mr. OFFOR was afraid that the property-tax would not form in any shape an accurate datum for the board to proceed upon with regard to the assessment. At all events, they must have one uniform rate for the whole of the districts. The City not being liable to county-rates, did not justify the property-tax being adopted as the basis for the taxation of this board. Moreover, there were great discrepancies in the returns as to the value of property. In one return the rateable value of property in the Tower Hamlets was put down at £1,697,604, whereas the return, under Schedule A of the property-tax, showed in the same district a rateable value of £2,214,332. 1s. 7d. This difference, no doubt, arose from the fact that, under Schedule A, tithes, manors, profits of railways and gas-works, &c., were assessed as well as rental of premises. Under such circumstances, there was a decided objection to take this tax as a criterion. Another thing, too: in poor neighbourhoods, many houses which were really assessed to the poor were exempt from the property-tax, the total incomes of the proprietors being under £100 a year. This of course applied to freeholds only; but, in reference to leaseholds in similar circumstances, the tax was only assessed upon the ground-rent, and not on the rack-rent. As a justice of the peace, he was quite aware that the poor-rate itself was not an unexceptionable rate; but, upon the whole, he believed it to be far preferable to the property-tax. The equivalent for this rate in the City was the paving, sewer, lighting, and consolidated rate; and, under all the circumstances, he thought the committee had pointed out a wise and a safe course for the board to adopt, and he hoped they would at once proceed to make their calls upon the parishes.

Mr. HAWKES thought that to adopt the poor-rate as their guide would not be safe or desirable. Every parish deducted different amounts from their ratings, some 6 and others as much as 10 per cent.; and, as such discrepancies existed, and the property-tax returns were also very deceptive, the board must either devise some better mode of assessment, or go to Parliament for further powers.

Mr. WRIGHT disagreed with the advice given by Mr. Offor, as he believed that the difficulty in which the board were placed at the present moment arose from a misconception of the terms of the act of Parliament. By the act they were required to take the county rate as their basis where there was one, and "a like estimate" where, as in the case of the City of London, there was not one. And whether the county-rate assessment were right or wrong, it did not matter, so far as they were concerned; nor would any error in that invalidate the precepts issued upon it by this board. The finance committee or the accountant had taken the consolidated rate of the City as "a like estimate," and it was for the board now to determine whether it was so or not. The mover of the resolution impugned the statement of the committee, and said that the assessment for the City was not based upon a like estimate, as the consolidated rate did not bear the same proportion to the property-tax that the county rate in the other metropolitan districts did. That was the real question for the board to decide.

Major LYON said, when the finance committee prepared the statement now under discussion, they had not before them certain information which it now appeared they could obtain, as to the assessment to the property-tax of the City. He believed, if they had had, they would have come to a very different conclusion. It was hardly fair, therefore, at this time to reflect upon them for the recommendation they had made.

Mr. KNIGHT quite agreed with the honourable member for Westminster, that the county rate was the proper basis for taxation generally; and he believed, too, that the consolidated rate in the City was in every respect on a parity with it. If the board, therefore, accepted the county rate with all its imperfections, why not also accept the sewers' rate with all its infirmities? The 171st clause of the act seemed to point out the sewers' rate in the City as the proper basis for taxation there.

The CHAIRMAN said, that clause simply gave the board the right to inspect the sewers' rate in the City.

After a few remarks from Mr. Dixon, Mr. Crellin, Mr. Wilkinson, and others, the question was put to the vote, when there appeared—

For the motion	19
Against it	12
Majority	— 7

Mr. WILKINSON moved, "That col. 1 of the financial statement, setting forth the rateable annual value of property, as per county-rate assessment, or like estimate, be referred for consideration to a committee of the whole board."

Major LYON seconded the motion.

Mr. WRIGHT thought it would be useless to refer a single column of the statement, and that a committee of the whole board could not so well deal with the subject as the finance committee. He therefore proposed, as an amendment, "That the whole financial statement be referred to the finance committee for reconsideration."

Mr. HOWS seconded the amendment, which, on a show of hands, was adopted.

Mr. DREW moved, "That it be an instruction to the finance committee to take into consideration, and report on, the expediency of borrowing, or otherwise providing, the amount of outstanding liabilities of the late Commissioners of Sewers, with a view to making the repayment thereof by annual payments of 2 per cent. and interest, instead of calling upon parishes for an immediate payment of the whole amount."

Mr. IRVINE seconded the motion.

The CHAIRMAN said, the question involved in the motion was so large and grave a one, that he felt he could not put it without previous notice.

The motion was accordingly withdrawn.

The CLERK read a communication from the vestry of Bermondsey in reference to the sum proposed to be assessed upon their parish by this board.

A motion to refer the letter to the finance committee was made by Mr. HOWS, and seconded by Mr. HARRIS.

Deputy HARRISON objected to the reference, and moved that the question be not now put, which was agreed to.

SITE OF OFFICES.

Mr. SEELEY brought up a report of committee on site of offices, stating the result of their communication with the City lands' committee, and recommending that a proposal be made by the board to the corporation of the City of London for taking a portion of the site of the former Fleet Prison in Farringdon Street, having a frontage of 100 feet, on a building lease for a term of 80 years, at a rent of 4 guineas per foot.

Mr. WILKINSON said he was instructed by his vestry to oppose any large outlay by the board for an official building at the present time, and he therefore moved, "That, inasmuch as the proposal to take a portion of the site formerly of the Fleet Prison in Farringdon Street, on lease from the City of London, would involve an outlay of many thousands of pounds, and considering that the board is engaged in carrying out large improvemements which will impose a very heavy amount of taxation on the metropolis, it would be inexpedient at the present time to incur such an expenditure; therefore it is resolved that the report be not adopted."

Mr. D'IFFANGER seconded the motion, believing that the board ought first to commend themselves to the respect of the public by the execution of some great works before they incurred so large an expenditure as that proposed by the committee.

A lengthened discussion ensued, and, a proposal to adjourn the debate having been negatived, the question was put to the vote, and carried by 13 to 9.

Several reports by the engineer on local works having been disposed of, the board adjourned.

FRIDAY, NOV. 28.

The Ordinary Weekly Meeting of the Board was held this day at Guildhall —Mr. THWAITES in the chair.

The minutes of the last meeting were read and approved.

RESIGNATION OF MR. CORRIE.

The CLERK read a letter from Mr. Corrie resigning his seat as member of the board for the parish of St. Pancras.

The resignation was accepted, and a communication ordered to be made to the vestry thereon.

METROPOLITAN SUBWAYS.

The CHAIRMAN said he had had an application made to him that day for copies of the lithographed plan and the book of reference of the proposed improvements in Southwark adopted by the board, and sanctioned by the First Commissioner. The parties seeking for it were the promoters of an undertaking for constructing a subway from the South-Eastern to the South-Western Railways, on the line of thoroughfare agreed to by the board, and by a continuation along Stamford Street to the Waterloo Road. He (the chairman) felt that the question was one of grave importance, as the possession of the plans before they were made public would seem to imply, to some extent, the sanction of the board to this undertaking. The urgency of the case to the promoters of the scheme, who were highly respectable men, was, that they were obliged to deposit their plans on the following day.

The CLERK read the letter referred to by the chairman, which stated that the writer (Mr. Robinson Latter) did not desire in the slightest degree to imply the concurrence of the board, directly or indirectly, in the plan of his proposed subway by the concession now sought.

Mr. LESLIE moved that the request be complied with. The introduction of a system of subways in London ought to be encouraged as much as possible by this board. It would be the greatest improvement that could be made in the metropolis, as by means of it sewers and gas and water pipes might be constructed, laid down, and repaired, without interfering with the above-ground traffic.

Mr. DENNIS seconded the motion, which was supported by Mr. WILKINSON.

Deputy HARRISON objected, not to the system of subways, but to the principle of allowing information of the kind desired becoming public before the time required by the standing orders of the House of Commons. Having been connected with improvements in the City for many years, he had seen instances in which great difficulties had arisen, and claims for compensation been created, by such requests being complied with.

Mr. TURNER said it appeared to him that a private company were applying to be supplied with information obtained at the public cost. It was, therefore, quite out of the ordinary course, and very unreasonable.

Mr. FEW said the board had already incurred the expense, and, as it would do them no harm, he hoped they would afford the information. It was only the question of a day, as on Monday morning any one could obtain copies.

Mr. DIXON thought there was an important question arising out of the proposal to construct a subway in that district. The whole area was very badly drained, and the board ought to take the opinion of their engineer whether or not this plan, if adopted, would interfere with the great intercepting sewerage scheme.

After some further discussion the motion was negatived.

PARK FOR FINSBURY.

The board then proceeded further to consider memorial from the vestries of the parishes of St. Mary, Islington; St. James and St. John, Clerkenwell; St. Mary, Stoke Newington; and the District Board of Works for St. Andrew, Holborn, on the subject of forming a park for the northern suburbs of the metropolis.

Mr. SAVAGE moved a resolution to the effect that the prayer of the memorial be complied with, and that the clerk be directed to take the necessary steps to enable the board to adopt the notices given by the petitioners, and that it be referred to the finance committee to settle the best mode of raising the necessary funds. He quoted the opinion of an eminent parliamentary agent, which had been obtained by the aggregate committees, to the effect that it was competent for the board to adopt the notices given by the associated parishes, or to amend the bill when in committee of the House, and then substitute this board for the memorialists. He could conceive of a no more legitimate exercise of the powers of the board than the formation of parks in the neighbourhood of the metropolis. He felt that the spirit of the act under which they were constituted pointed to works of this class as of the next highest importance to those of drainage. Well and truly had these open spaces been characterised as "the lungs of London;" and, unless some steps were speedily taken to secure them from being built over, they would soon be covered in every direction with brick and mortar. For the board to adopt the resolution he had submitted, would be the most popular step they could take; nor did he know of a better argument they could use when they went before their constituents next June, to give an account of what they had done during the first eighteen months of their existence.

Mr. D'IFFANGER seconded the motion. He was compelled to do it, because he was so strong an advocate of the project for preserving Hampstead Heath, and he could not, therefore, consistently begrudge a park to other localities. The cost of all the parks which had come, or were likely to come, before the board would not exceed £500,000, or about 1d. in the £1 for the next ten years. The board had been created for three distinct purposes: first, the construction of sewers; second, to promote the improvements of the thoroughfares of the metropolis, and regulate the erection of buildings; and, third, the formation of parks; and, if they neglected the latter, they would show themselves to be incompetent to the duties assigned them. Although he had no notion of doing this as an electioneering trick for next year, he believed it would be a very popular measure.

In answer to a point of order raised by Mr. TAYLOR, the CHAIRMAN ruled that the resolution of the board of the 4th of June had special reference to the question of the preservation of Hampstead Heath, and did not preclude them from entertaining the present motion.

Mr. DOULTON thought it was nearly time that the board began to think about the mode of raising the enormous funds they would require. He had no such faith in the pliability of the ratepayers as the mover of the resolution evidently had. In plain language, he did not believe they would "stand it." He would give way to no man in his desire to see parks and open spaces around the metropolis; but he did not think the board had the power, or, if they had, that it would be sound policy to exercise it, to tax the ratepayers for such a purpose. The formation of parks was either a local or a national question; if the former, the parishes benefited ought to contribute the cost; if the latter, it should come out of the national purse. In the present case, he considered the Government had come forward very handsomely in offering £50,000, and that it would be creditable to the inhabitants of the united parishes represented in the memorial to contribute the remainder. The mover of the resolution told them that, by adopting his proposition, they would make themselves popular. Whatever effect it might produce in that direction with Mr. Savage's constituents, he (Mr. Doulton) was persuaded it would have quite the contrary effect with his; and he felt that he should be only doing his duty by voting against this motion, and supporting the construction of works of much greater importance. But he had been informed that one of the parishes referred to in the memorial had come to the resolution not to have anything to do with this proposed park; so that, after all, it was not so popular a subject as they had been led to suppose, even amongst those more directly interested. He hoped the board would adopt some resolution which, while admitting the desirableness of having these open spaces preserved to the public, would recognise and sustain the rights of the ratepayers of the metropolis not to be taxed exclusively for their creation and maintenance.

Alderman CUBITT said it was quite clear that these breathing-places were a great desideratum to the metropolis; and also that, unless this board took up the question of their preservation, no one would do it. If, then, it was desirable, and the board had the power to promote them, surely it would be creditable to them to take some steps in that direction. The Government had offered £50,000 towards this particular one, and probably the inhabitants would be disposed to do something themselves, if it were made a condition by the board; but he did not think it would be right to call upon the surrounding parishes for the whole. It had been said that the Government paid for Victoria Park, and ought to pay for this; but it was evident they would not; and, let it be remembered, that at the time Victoria Park was formed, there was no Metropolitan Board in existence. When the Metropolis Local Management Bill was in the House of Commons, there was a desire to charge this board with duties of grave importance, the performance of which would entitle them to the confidence of the ratepayers and of the country at large; and it appeared to him that in such a course as that now submitted to them they could secure much credit to themselves, and promote a great public benefit. There were many duties that would devolve upon them which were of national importance, and he believed they would be able to go to Parliament at a future day and ask for national assistance in carrying them out; and amongst these, perhaps, such works as those now under consideration might be included.

Mr. H. L. TAYLOR admitted that the board had been called into existence to do a variety of important and necessary works, and that the machinery for the purpose was most extensive; but, seeing the urgency of the drainage question, and the improvements of the metropolitan thoroughfares, each of which involved an enormous outlay, it became them to have respect, not only to the gratification of their own desires as to the preservation of open spaces, but to the pockets of the already overburdened ratepayers. Let it be remembered that, independently of the calls which this board would have to make for necessary works, the various parishes had to contribute largely for local drainage and improvements, which made it imperative that some limit should be imposed upon the various schemes brought forward for parks and open spaces. The estimated cost of this park was £150,000 beyond the Government grant, and towards this the City of London and the parish of St. Marylebone would each have to contribute a tenth. Surely this was not a very popular subject for the honourable member who seconded the proposition for carrying it out, to appear before his constituents with next June. If the inhabitants of Finsbury desired a park, by all means let them have it, but let not those who derived no benefit be called on to pay for it. The parishes represented in the memorial had shown great perseverance, but very little public spirit, in this matter, or they would have said, "The Government are going to give £50,000, and we will raise another £50,000 in the district, if the board will help us with the remainder." This would have been a proof, at least, of their sincerity in the matter, creditable to themselves and encouraging to the board to assist their efforts.

Mr. HOWS regarded the matter, not as a national or local, but as a metropolitan question; and, as some honourable members had latterly taken up the idea of delivering public lectures on subjects metropolitan, he would suggest for their consideration the propriety of taking for a topic, "The Mission of the Metropolitan Board." He considered that in carrying out that mission they were a great sanitary body, called into existence to purify London, and promote the health of the inhabitants. Surely, then, they could not better secure that object than by giving to their constituents some few breathing-places in the suburbs.

Mr. TURNER supported the proposition in principle, but thought it would be better to refer the whole of the applications respecting parks to the committee of works, for them to examine and ascertain the facts as to probable expense, and the priority which should be given to each. He moved an amendment to that effect.

Mr. WILKINSON, believing that that was by far the most equitable way of dealing with the question, seconded the amendment.

Deputy HARRISON admitted that the board had the power, but very much questioned the propriety of their taking up the question at all at present. They had already resolved on several great metropolitan improvements, which involved the necessity of making large calls upon the ratepayers, and it was desirable to see how these were borne before attempting anything else which was not absolutely imperative. During the present year, for the general purposes of this board, it was necessary to make a call upon the parishes and districts of a sum varying from 1s. 9d. to 2d. in the pound—no inconsiderable sum in addition to the local taxation.

The CHAIRMAN said there had been some little misapprehension upon this point with the public. The maximum rate referred to by the Deputy only applied to one or two districts, and arose from the fact that they had to contribute to the repayment of a loan effected for works executed in those districts. There were only four districts whose rate would be above 6d. in the pound.

Deputy HARRISON did not mean to convey the idea that the higher sum would be the average rating, but what he wished to urge was, that the obligations of the board at the present moment were such that, if it was desired that it should be a permanent institution—popular as well as useful—they must not tax the ratepayers for works not absolutely necessary to be carried out ot once. They had already agreed to improvements which would cost £750,000, and let them remember that for every £50,000, they required an additional 1d. in the pound from the ratepayers. Then came the great intercepting sewerage scheme, towards which, he hoped, they would in the next twelve months require a million of money; for, when once begun, the greater the expedition in carrying on the work the better. It had taken the Government years to consider the propriety of expending so much public money as was required for the Islington park, without any definite decision being come to. And yet, without having seen the plans, and without knowing any particulars at all about the scheme, this board were asked to adopt the notices given by the memorialists, and expend the money of the inhabitants of the metropolis upon it. The most reasonable and proper course was to adopt the amendment.

The debate on this subject was protracted for a considerable time, and ultimately the amendment was adopted by 20 to 9, two or three amendments thereon having been negatived.

FINANCE.

Mr. OFFOR brought up a report from the finance committee, which stated that the total general balance in the hands of the treasurer on the 25th of November was £109,018. 2s. 2d., and recommending that the sums specified in the statement submitted to the committee, amounting in the whole to £12,011. 14s. 6d., be paid; and, for the purpose thereof, that the sum of £10,000 be removed from the deposit account, and placed to the current account of the board.

The recommendations were at once agreed to.

The committee further reported, "That the funds which would be available towards purchasing land for the purpose of forming a park in the neighbourhood of Highbury or Hornsey, for the borough of Finsbury and the north of London, would consist of moneys and rates to be assessed by this board on the metropolis under the Metropolis Local Management Act, and of a sum of £50,000, which it is understood that the First Lord of the Treasury has promised to advise should be granted by her Majesty's Government for this purpose, upon the remainder of the cost being raised from other sources; and that, in case there should be any surplus from the coal-tax, some portion of that surplus might, in the opinion of the committee, be equitably appropriated towards the formation of the park in question, or any other park, for the benefit of the inhabitants of the metropolis."

MR. M'LEAN'S SCHEME.

The CLERK read the following letter from Sir S. Morton Peto, relative to the carrying out of the plan of Mr. M'Lean for the drainage of the metropolis, and requesting to be allowed to attend the board, with Mr. M'Lean, to explain the same.

Somerleyton Hall, Suffolk, Nov. 24, 1856.

My dear Sir,—I am most anxious that, before you finally decide upon the outfalls for the metropolitan sewerage, you should have all the points of Mr. M'Lean's plan fully before you; and I shall be greatly obliged by your allowing me to attend you, with that gentleman, to afford you the necessary explanation. The imperative importance of the subject will, I trust, be considered a sufficient excuse for thus troubling you. The whole of the plans and sections of the proposed outfall sewer to the German Ocean being now completed, you can have all the necessary information with accuracy, so that your decision may be taken without delay. The levels taken show such a difference between the height of the top water of the aqueduct at West Ham, as shown in the sections of the engineer of the Metropolitan Board of Works, and the level of the spring tides of the German Ocean at the point of discharge, as will admit a velocity of nearly three feet per second. The sewer will be capable of discharging the whole of the sewerage and rainfall estimated by the engineer of the Metropolitan Board of Works, without any additional pumping, in a continuous stream, and at all times of the tide. With the assumed velocity of three feet per second, there will not be any deposit of sewerage, except at places selected specially for that purpose; and this velocity is not only sufficient to prevent the deposit of any soil, but is equal to removing broken stones as large as those used generally for metalling roads. As regards estimates, the sum of £1,600,000 will be sufficient for executing the works, &c., between West Ham and the sea. The locality of the outfall is admirably adapted for chemical works of every description, if requisite, in connection with the sewerage, and is so far removed from habitations or places where houses are likely to be built, that such works could never become a nuisance; and it has the advantage of close proximity to the Rivers Crouch and Blackwater, both of which form excellent harbours. From the best data I can obtain, I am led to believe that the proposed outfall at B, in the metropolitan plans, will cost [the writer here enumerates the several items] £1,140,356. The comparison will therefore stand in outlay at £1,600,000 as against £140,356; and in making this comparison I assume that the cost of conveying the sewerage from the south side, including the sewerage of Greenwich and Woolwich, to the outfall sewer of the north side will not be greater than the cost of the proposed outfall sewer on the south side. Indeed, instead of a difficulty in adopting the system of sewerage proposed by your engineer for the south side, it will much simplify the work of collecting the sewerage at Southwark Bridge, intead of at Deptford Creek, as it will not be necessary to make any portion of the sewer below low water, as at present proposed by the engineer of the board. You will, by the adoption of Mr. M'Lean's plan, entirely get rid of all reservoirs and pumping at the outfall, and the Thames will be left perfectly clear of sewerage matter; and the proprietors of land in South Essex, by the memorial so extensively signed, showed their great anxiety for the adoption of the plan; so that no opposition of a local nature need be feared by you, if, after deliberation, you should approve of the plan. I have no desire in any way to be connected with the execution of these works, my only object being that the plan should have ample consideration given to it. I feel a deep interest in the subject from having sat two years in the Sewers' Commission; but, that you may feel the difference in expense is not an insuperable barrier to the execution of these great works, I am willing, with my friends, if you will pay, by way of a rent in perpetuity for the use of the outfall sewer to the German Ocean, an interest of 5 per cent. per annum on the cost of your own outfall and the works connected therewith, to construct the outfall to the sea, and that you have the free use of it for the rent so paid. I make this offer that the subject may be treated on its own merits, an advantage fully equivalent to any difference being obtained at the outfall into the sea; for, outside the present sea wall, and lying between the Rivers Blackwater and Crouch, is an extensive foreshore, capable of being reclaimed; and there is an area of about 6 miles long and 1 mile broad, or nearly 4000 acres, which might be at once treated in this way; and there are upwards of 20,000 acres more which might be similarly treated, from time to time, by sewerage, not otherwise utilised, being discharged over it. Thus, that which will, in the case of the Thames outfall being adopted (treat it as you will), become a nuisance on the South Essex shore, will become a public benefit and a source of income. It appears to me that this great subject should be grasped with a determination so to treat it

that the works executed should be sufficient for all time, and able to meet the contingency of any future increase of the metropolis; and any little delay in coming to your determination would be far more than counterbalanced by the right conclusion being arrived at. (Signed) S. Morton Peto.

To E. H. Woolrych, Esq.

Mr. D'Iffanger moved, "That Sir S. Morton Peto's letter be acknowledged, and that he be requested to attend the meeting of the board on Tuesday next, to explain the details of the plan referred to in his letter for the drainage of the metropolis." He said it was only courteous to those who had given so much attention to the question, that the board should afford them the opportunity of stating what their plan was.

Mr. Nicholay seconded the motion, believing it to be their duty not to suffer one farthing of the money of the ratepayers to be expended beyond what was absolutely necessary.

Mr. Carpmael said, the letter referred to very extensive plans; and, if it was intended that the subject should be taken into consideration, it was very desirable that those plans should be before the board. There was this difference in the present to the former plan brought up by Mr. M'Lean, that now they were to dispense with the upper line of sewers for the Surrey side altogether; and his (Mr. Carpmael's) opinion was, that it would be impossible to get a good drainage scheme for those districts without. Such being the case, although, had it been the old scheme, he would have advised the board not to have anything to do with it, he did feel curious to see the plans and estimates, so as to be able to deal with the matter when it fairly came under consideration.

The Chairman said as Mr. M'Lean's plans had been before the public, and an erroneous opinion had been formed respecting them, it seemed to him very desirable that an effort should be made to set the matter right. On two points at least the public mind should be disabused. It was generally understood that this plan of Mr. M'Lean was a general drainage scheme for the whole metropolis; and the idea had got abroad that, though the Metropolitan Board had expended so many months in considering the subject, and had determined upon a much more costly plan, here was a private party who was willing to accomplish all the objects which they contemplated for £1,600,000. Nothing could be more fallacious than such an opinion; the state of facts disclosed warranted no such conclusion. When Mr. M'Lean was before the board, it would be remembered that, in answer to the various questions put by him (the chairman) and other members, it appeared that, in the first place, it was contemplated to collect all the sewerage of the south districts of the metropolis at the Surrey side of Southwark Bridge, to lift it there, and carry it across to join the sewers on the north side, and from thence to convey the whole to the Crouch river by one tunnel, and pump it up there in order to get it into the German Ocean. It had to be lifted at the foot of Southwark Bridge, where it would require to be pumped some 70 or 80 feet (speaking in round numbers), carried over by means of iron tubes, and then dropped as many feet as it had been raised; then carried on to West Ham, and there lifted a second time into the sewer which should convey it down to the Crouch. The question put to Mr. M'Lean was this—"You make the assertion, as an engineer, that the sewerage can be collected at the foot of Southwark Bridge; have you or have you not ascertained the inclination of the present sewers on the south side of the Thames, and in what direction they run? and are you aware that they all have an inclination from west to east?" Mr. M'Lean did not appear to have entered into that question, or the more general one of *how* the sewerage could be collected at that spot. It was evident that to do that involved the necessity for constructing a large sewer all the way from Plumstead Marshes, at the limit of the metropolitan area, in order to bring the sewerage back from that outlying district, and to receive in its course the sewerage of Woolwich, Greenwich, Deptford, Rotherhithe, and Bermondsey. Then, again, it required the entire reversal of the great net-work of sewers at present existing in that district, and which had been constructed at a large cost to the ratepayers. Next, Mr. M'Lean proposed to erect a pumping apparatus at Southwark Bridge, sufficient to lift the whole of this sewerage the required height to get it to the other side.

Mr. Leslie: Yes, and at whose expense? That is not included in the £1,600,000.

The Chairman: He did not seem to have taken into consideration the enormous additional cost of this work, nor of that which would be necessarily involved in increasing the capacity of all the sewers on the northern side, in order to carry the sewerage of both districts. He seemed also to forget that the people of Southwark, who are generally wide awake enough to questions affecting their interests, would never permit the collection of the whole of that immense quantity of refuse at the foot of the bridge, and the construction of a huge reservoir to contain it. These things seemed to have been entirely overlooked, and when pressed upon the question, he said these were matters for the board to do. Now, really it was scarcely fair to the board, or to the public, that a scheme should be propounded, and a contrast run between it and the one under the consideration of the board, when such important items of an engineering and financial character were omitted by Mr. M'Lean. He (the chairman) believed that by his plan Mr. M'Lean would require pumping power on the southern side two and a half times more than that proposed by Mr. Bazalgette; and, capitalising that annual charge, it would amount to something like three-quarters of a million of money. To exclude an item so obviously a part of the scheme, to publish it as a plan for the drainage of the metropolis, and to run a contrast between this and the one proposed by the engineer of the board, was hardly fair. He (the chairman) did not believe that Sir S. M. Peto would lend himself to anything which had any deception upon the face of it; and he had, no doubt, taken up this plan with a desire to see that object carried out effectually which the board had it in charge to execute. It was only right, then, that as the scheme had been made public, and had been put forward in contrast with their own, it should be as publicly known that this was not a plan for the drainage of London proper, but simply a proposition to take the sewerage from the hands of the engineer when he had carried it beyond the bounds of the metropolis and into the Essex Marshes, and to extend it for several miles towards the sea, which would be no direct benefit to the metropolis at all—taking it, in fact, from near a point beyond which it was hardly necessary for the board to go. Under such circumstances, the question was one for the Government rather than the board to deal with, if they were desirous to relieve the river beyond the area of the metropolis. Clearly, it was not a case in which the board could consent to tax the ratepayers 5 per cent. upon the amount of capital proposed to be employed in such work; and the misunderstanding which had arisen in the first place made him (the chairman) desirous to offer these few observations upon the subject.

Mr. Leslie hoped the board would not commit themselves by asking Sir S. M. Peto or Mr. M'Lean either to attend and explain the proposed scheme, which was a most absurd and impracticable one. In his letter Sir S. M. Peto said, in reference to the sewerage of the south side, "it will not be necessary to make any portion of the sewer below low water." Why, that was the cause of all the mischief at the present time on the Surrey side; the district was in many parts below low-water mark, and hence the constant floodings. When Mr. M'Lean was before the board, he was asked the question as to the form of his open sewer 16 miles long, and he said it would be circular! Now, the board had no power to construct or to sanction a large open sewer, or to have anything at all to do with so monstrous a thing, and therefore it would be perfectly absurd to ask the parties to attend and explain the details of their plan. So absurd a scheme was never heard of before. Nothing at all approaching it had ever been proposed to this board. Why, what did Mr. M'Lean say? That he approved of everything which Mr. Bazalgette had done, and did not want to alter a single item; and yet it appeared that, to adapt the one plan to the other, all the sewers on the Surrey side of the Thames, east of Southwark Bridge, must be reversed, a large pumping establishment erected at the foot of the bridge, and of course a reservoir to contain the sewerage; and all for what? To get the sewerage carried down to the German Ocean, or rather to that part of the River Thames the other side of Southend! As an old commissioner of sewers, he remembered that a plan had been before proposed for conveying the sewerage down to the German Ocean by the Crouch, and that it was immediately met with the objection, that it would destroy the whole of the oyster trade of the river. This was another of the Great George Street schemes, and till the board got entirely clear from them they would not be right.

The Chairman said he had seen Sir Morton Peto, and had stated to him very frankly what he had stated to-day; and had told him, moreover, that it was more a matter for the Government than the board, which would certainly never be justified in taxing the ratepayers in perpetuity with 5 per cent. upon a large outlay in the construction of works below the point they were obliged by the act of Parliament to go.

Mr. Crellin, Mr. Hows, and Mr. Turner having made a few observations, the motion was put and negatived.

The board then adjourned.

Tuesday, Dec. 2.

A Special Meeting of the Board was held this day in the Council Chamber, Guildhall, to receive the report of the engineer on the points of discharge for the drainage of the metropolis suggested in Captain Burstall's letter, and approved by the First Commissioner of Works, and on other matters connected therewith—Mr. Thwaites in the chair.

Deodorising Works.

Mr. Wilkinson introduced a deputation from the vestry of St. Pancras, to present a memorial on the subject of the metropolitan drainage. The memorial stated that, it having been reported to the vestry that the Chief Commissioner of her Majesty's Works had approved of an outfall at Rainham Creek, and it appearing that the subject of the deodorising and utilisation of the sewerage had not been brought prominently under the notice of that member of the Government, the vestry felt it incumbent on them to call upon the board to take some steps to ascertain the practicability of the scheme, and to defer their final decision on the intercepting sewerage plans until such inquiry had been made.

Mr. Garvey, on behalf of the deputation, stated that the general feeling in the parish of St. Pancras was, that to discharge the whole of the sewerage into the Thames would be highly objectionable on many grounds. They considered that it was objectionable on sanitary grounds, for it was well known that rivers polluted with sewerage matter formed a most powerful and very peculiar attraction for cholera. Of this they had the best proof in the report of the Sanitary Commission issued in 1847, which commission was appointed to inquire into the best means of promoting the health of London; and before which it was given in evidence, by a gentleman of the highest authority, that the spread of cholera throughout Europe, and the manner of its propagation, were uniform; that it followed the course of navigable rivers and water-courses, especially such as were polluted with sewerage. St. Petersburg, Moscow, Vienna, Berlin, Paris, London, Sunderland, Newcastle, Manchester, &c., and all the towns where the cholera committed its greatest ravages, were so situated; and, therefore, the memorialists felt that they had, *prima facie*, a good ground for objecting to the discharge of the sewerage into the Thames on sanitary grounds. They respectfully begged the board, therefore, to reconsider their former decision on the subject. Then, on economical grounds, it was shown by Mr. Bazalgette, the engineer of the board, in his report presented on the 25th of September, that the establishment of deodorising works would greatly lessen the expense of the sewerage scheme which he had submitted. It was also recommended by Mr. Bazalgette, that in any case, deodorising works should be adopted for the sewerage in the western district of the northern area of London. Such being his recommendation, the vestry thought it was incumbent upon the board to take into consideration the possibilty of adopting that process. They left out of view altogether at present the question of the agricultural value of the sewerage, but they felt that it became the board not to shut out the possibility of its utilisation by adopting so distant an outfall as entirely to preclude the application of any plan which science might hereafter devise for the purpose. It had been shown by Mr. Bazalgette that a vast extension of structural works would be necessary if the plan which the Chief Commissioner had thought proper to sanction was carried out, and that the whole of this extra expense, amounting to something like £1,000,000 sterling, might be saved by the adoption of the deodorising process.

The Chairman: You say £1,000,000 might be saved by one plan as contrasted with another. With what do you contrast the engineer's present plan?

Mr. Garvey said, with Mr. Bazalgette's first plan for deodorising works at Barking Creek, on the north side, and a corresponding locality on the south side of the Thames. He would not be positive that the exact saving would be a million; but it was a large sum—quite sufficient, as he conceived, to warrant the board in taking the matter into their consideration. It was shown also, in the report of the Sanitary Commission to which he had referred, that such a vast extension of the main sewers would be, in point of fact, but the creation of extended cesspools and manufactories of foul air, and that the necessary process of flushing would drive that foul air back to the most distant parts of the metropolis. At page 23 of the "First Report of the Sanitary Commissioners of 1847," it was clearly proved that in the upland division under the old Commission of Sewers, when the flushing was being carried on, the foul air was driven as far as those parts of the district near the New River Head. The deputation would not presume to state their views so positively to the board, were they not persuaded that the plan which they recommended could be carried into practice. In fact, there was already a practical exemplification of it in the town of Leicester, where the deodorising process had been successfully adopted. It was known to most of the members of the board that, in 1853, a parliamentary committee, presided over by Lord Seymour, approved of, and recommended to the House of Commons, a plan conducted upon the deodorising principle. He would not trouble the board further than to say, that on these ground he thought it was incumbent on them, before finally and irrevocably deciding on the scheme approved by the First Com-

missioner, to take this question into their consideration. He was informed that the parties who promoted the plan which was approved in 1853, were now ready to lay before this board a similar one for their consideration.

Mr. CARPMAEL inquired how long the vestry of St. Pancras had had the subject of deodorising works under consideration?

Mr. GARVEY could hardly speak positively as to the whole of the vestry; but for those members of it that formed the present deputation, he would say more than six months.

Mr. CARPMAEL: Have you made yourselves acquainted with the probable cost of deodorising the whole of the sewerage of the metropolis?

Mr. GARVEY: We took Mr. Bazalgette's estimates. He states in his report that the original outlay would be less than any other scheme, but the annual charge would be greater, leaving out of consideration the utilising of the sewerage.

Mr. CARPMAEL: You state that, if the outfall approved by the First Commissioner were adopted, it would shut out the possibility of having recourse to deodorising works. How do you realise that in your mind?

Mr. GARVEY: I come to that conclusion from the simple fact, that if you discharge all the sewerage into the Thames it will be impossible to deodorise it.

Mr. CARPMAEL: Why not deodorise it at the place approved by Sir B. Hall for an outfall?

Mr. GARVEY: For these reasons: first of all, the offensive effluvia will have to pass over a large extent unnecessarily, and then that you will have to spend an additional million of money for carrying away that which could be better dealt with nearer London.

Mr. CARPMAEL: An additional million upon what?

Mr. GARVEY: Upon plan A, which was laid before you by the engineer.

Mr. CARPMAEL: Have you any reason to suppose that there will be greater difficulty in deodorising at the point B than at A?

Mr. GARVEY: No; but we think, if the deodorising process is adopted, it would be far more economical to carry it out at the latter than to extend the sewerage to the former.

Mr. CARPMAEL: Are you aware that the extra cost of deodorising would be £40,000 a year for lime alone?

Mr. GARVEY: I was not aware of that; but I am perfectly aware of this, that there are parties prepared to carry out the deodorising principle without putting you to any such expense.

Mr. CARPMAEL: Unfortunately, they have not presented themselves to this board. Do you take this matter up on sanitary or economical grounds?

Mr. Mr. GARVEY: On both. We recommend the adoption of the plan—first, on sanitary considerations; secondly, on the ground of economy; and, thirdly, because it affords the opportunity for utilising the sewerage at some future time.

Mr. CARPMAEL: But that is common to A as well as to B?

Mr. GARVEY: No; the fertilising properties of the sewerage are deteriorated between the two.

Mr. CARPMAEL: But they are only half an hour's flow apart.

Mr. GARVEY: Then there is the increased cost of construction.

The CHAIRMAN: Are you speaking from facts when you say £1,000,000 would be saved?

Mr. GARVEY: I do not say that is the exact amount, but the engineer can tell you.

Mr. BAZALGETTE was about to offer some observations, but

Deputy HARRISON objected to an officer of the board assisting a deputation to make out their case.

The CHAIRMAN: The only thing is, that it informs the public. If the deputation state that the additional cost in going from A to B is £1,000,000, and that is contrary to fact, is it not desirable that they should be set right?

Mr. H. L. TAYLOR submitted that it would be better to elicit the fact from the engineer after the deputation had made their statement.

In answer to Mr. Leslie, Mr. GARVEY said the vestry of St. Pancras was quite alive to the paramount importance of perfecting the system of sewerage in the metropolis. He was not aware that for ten years past the various schemes for deodorising sewerage had interposed the most formidable hindrance to the drainage of London. He was most anxious to see the work accomplished, but he thought that to take the sewerage out of London, and throw it into the Thames a few miles below the metropolis, was only exchanging one evil for another.

Mr. CRELLIN inquired whether, if it were proved that the deodorising process was the most expensive, the deputation would still urge its adoption?

Mr. GARVEY said, on sanitary considerations they would certainly do so, as it would effectually save the river from pollution.

Mr. BURSLEM: Are you aware whether Mr. Wicksteed is making a fortune by the process? You said it was very profitable.

Mr. GARVEY: I said it was successfully adopted at Leicester; by which I meant, that the effluvia arising from sewerage refuse was effectually destroyed. I meant, successful in a chemical point of view.

Mr. LESLIE: Has your vestry ever had the water analysed after passing through this deodorising process?

Mr. GARVEY: No.

Mr. LESLIE: Do you suppose that, having passed the sewerage water through lime, the valuable fertilising properties are extracted, and the water passes off clear and harmless?

Mr. GARVEY: There are many processes, and we do not confine ourselves simply to the agency of lime.

Mr. LESLIE: But we are now speaking of Mr. Wicksteed's process. Do you know the effect produced on the water?

Mr. GARVEY: It is perfectly clear.

Mr. LESLIE: Does it ever get into a state of fermentation afterwards?

Mr. GARVEY: No; I believe not.

Mr. HOWS: I should like to know whether you have been to Leicester, and witnessed the complete success you have spoken of?

Mr. GARVEY: No, I have not; but I have the fact on the best possible authority: I have it on the testimony of a gentleman who has himself investigated the process.

Mr. D'IFFANGER: I want one point to be made clear. A highly respectable deputation come here to state that a million of money may be saved by the adoption of a certain plan, and I think it right the public should know the grounds on which they base their calculation.

Mr. GARVEY: I thought I had explained it. The saving is entirely in the construction of the sewers. If the plan sanctioned by the Chief Commissioner be adopted by the board, the sewers will have to be extended to Rainham Creek; if the sewerage be deodorised, it need not be taken to so great a distance, and the saving in the cost of construction we estimate at about £1,000,000.

Mr. D'IFFANGER: Have you taken into consideration the cost of erecting deodorising works, and their annual expense?

Mr. GARVEY: No; we simply take the figures in Mr. Bazalgette's report.

Mr. FEW: Are you not aware that, in his report, Mr. Bazalgette says that, if deodorising works are added at *A*, the probable working expenses will be £85,000, which, capitalised at 5 per cent., would be an increase of the cost of £1,700,000.

Mr. GARVEY: We understood that the annual expense would be greater, though the cost of construction was less.

Mr. FEW: But that is quite irrespective of the annual expense.

Mr. GARVEY: We do not advocate any particular plan of deodorising, but only ask you to take the subject into consideration.

Mr. FEW: What other schemes of deodorising have come before you?

Mr. GARVEY: I am not authorised by the vestry to advocate any particular plan.

Mr. IRVINE: You would advise, however, that whatever plan was adopted, it should be carried out as near to the fountain-head as possible?

Mr. GARVEY: No doubt.

Mr. IRVINE: You were asked the question whether you knew that the sewerage waters, after being deodorised for some time, became fermented, and had an offensive smell. Are you aware that all river water passing through towns would, if corked up for a considerable period, show the same results?

The CHAIRMAN: That is rather arguing the point. The deputation have come here on two grounds: first, to urge that the erection of deodorising works will lessen the expense to the ratepayers; and, secondly, that they will more completely secure the sanitary condition of the metropolis. I may just state, however, as one fact out of many, that if the board were to adopt the deodorising process at points much nearer than those suggested by the deputation—viz., at Deptford Creek, and the Lea, and the western division at the Kensington Canal—the additional cost, capitalising the annual charge, would amount to £300,000 more than the plan proposed by the engineer, including pumping power.

Mr. TURNER: Did the deputation come here under the impression that the board had never looked at the question of deodorising?

Mr. GARVEY: We were not aware that the matter had been taken into consideration.

Mr. LESLIE: Are you aware that our predecessors employed Mr. Wicksteed to make a report on this subject, and that he proposed the expenditure of a million of money in the construction of deodorising works?

Mr. GARVEY: Yes, we have seen the report.

Mr. RASHLEIGH said: The above sum includes the cost of an embankment of the river.

The deputation then withdrew.

Mr. WILKINSON moved, and Mr. TURNER seconded, the reception of the memorial, which was at once agreed to.

Mr. BOYSON presented a memorial from the parish of St. Mary, Newington, urging upon the board not to incur any large outlay for drainage works beyond what the exigencies of the metropolis itself demanded. The vestry stated that the plan originally proposed was far less expensive than the one now contemplated, and that the additional cost had been caused by governmental interference; and, although Government property—occupying as it does so large a portion of the river bank—was so greatly benefited by the proposed extensions, no portion of the expense would be assessed upon them. They urged that the national funds had been applied in the construction of streets and parks in the metropolis, none of which could bear any comparison in importance to the great scheme of intercepting sewerage.

The memorial was received.

ENGINEER'S REPORT UPON MAIN DRAINAGE OUTFALLS.

The CLERK having read the report of the deputation appointed by the board to confer with Sir B. Hall, and stating the result of their interview,

Mr. BAZALGETTE proceeded to read the following

REPORT:—

To the Metropolitan Board of Works, upon an extension of the Drainage Outfalls adopted by the Board on the 22nd of October, 1856, to points approved by the First Commissioner of her Majesty's Works, &c.

Extract from the Minutes of the Board, Nov. 21, 1856.

"That the engineer be instructed to prepare a plan and report upon the points of discharge suggested in Captain Burstall's letter, and approved by the First Commissioner of her Majesty's Works, &c."

Engineer's Department, No. 1, *Greek Street, Soho, Dec.* 1, 1856.

Gentlemen,—The point and mode of outfalls for the metropolitan drainage which have been approved by the First Commissioner of her Majesty's Works, &c., marked B[2] upon the accompanying map, require an extension of 5 furlongs further eastward in Hornchurch Marsh, on the north side of the Thames, and of 1 mile in the Erith Marshes on the south side.

The outfalls would now be 15 miles below London Bridge, and it is proposed to confine the periods of discharge from them within 1½ hour before high water and 2½ hours after high water—with certain exceptions hereinafter named—giving a period of 8 hours' storeage and 4½ hours of discharge per tide.

The official return of the quantity of water now supplied by the water companies to the metropolis, which has just been issued, shows that the supply has increased from about 7,000,000 to 13,000,000 cubic feet per day within the last six years, and it is more than probable that the quantity of sewerage discharged from the sewers has increased in the same ratio since they were last gauged in 1853-4. Making, therefore, a liberal allowance for such increase, it may now be assumed to have amounted to nearly 9,000,000 cubic feet per 24 hours on the north side of the Thames, and 3,250,000 cubic feet on the south side. Thus, the quantity which would now be collected in the reservoirs during the 8 hours they were closed would amount, on the north side, to nearly 3,000,000 cubic feet, and on the south side to rather more than 1,000,000 cubic feet.

The bottom of the reservoirs would be 2 feet above Ordnance Datum, or at the level of the ebb tide at 2¾ hours after high water; that being the period when the discharge of sewerage into the river would cease.

The level of the overflow Weir would be 16¼ feet above datum, and the mean depth of the reservoirs would be 14 feet. The reservoir on the north side would cover about 10 acres, and contain about 6,000,000 cubic feet when full; that on the south would cover about 4¼ acres, and contain about 2,750,000 cubic feet when full; so that the average daily flow of sewerage, during dry weather, would about half fill the reservoirs in 8 hours.

In order to arrive at a more accurate idea of the time and mode of discharging the sewerage from the reservoirs, I have appended to this report an abstract of the quantity of rain which fell last year, as observed at this office. From this it appears that there were 226 days in that year upon which there was no rain, 90 days upon which there was less than 1-10th of an inch, and 21 days upon which there were rainfalls varying in depth between 1-10th and 1-5th of an inch; making 337 days upon which less than 1-5th of an inch of rain fell, and 28 days upon which that quantity was exceeded.

Upon the 226 dry days the reservoirs would, as already shown, be on the average only half full at the end of 8 hours; therefore it would be not only unnecessary, but also impossible, to discharge any portion of their contents into the river during the last hour of flood tide, because the tide would during that period be above the level of the sewerage in the reservoir; and the tide would then be allowed to flow into the reservoir, diluting its sewerage, and raising its level to that of high water in the river. The discharge of sewerage would on those 226 days commence immediately after high water, and would be completed within 2¾ hours; by which time the tide would have ebbed below the bottom of the reservoir. Upon the 90 days of minimum rain-fall, it appears that, after making the necessary deductions for the amount of

evaporation, absorption, and the time occupied by the rain-waters in flowing from remote portions of the district to the point of outfall, the reservoir would not be more than about two-thirds full; and therefore the period of discharge would on those 90 days also take place only during the first 2¾ hours of ebb tide. Upon the 21 days the reservoir would probably be nearly filled during the 8 hours, and the discharge would then commence 1¼ hour before high water. Upon the remaining 28 days of heavier rain, the discharge would take place at earlier periods, varying with the amounts of rain that had fallen.

The reservoirs, as at present designed, will therefore always contain a sufficient amount of reserved space to hold the metropolitan sewerage, estimated as being due to the anticipated increase of the population and water-supply in future ages, and produced within 8 hours; taking also into consideration the unequal flow of that sewerage during different portions of the day. The reservoirs might, however, be added to hereafter, from time to time, without difficulty or disadvantage, if considered necessary; and this mode of enlarging them, by adding a second basin, would be preferable, in an engineering point of view, to now constructing one basin of increased area. I do not, however, recommend any enlargement of the reservoirs beyond the dimensions now named, in order to include within 8 hours the rain-fall due to the 28 days per annum, because to do this would spread the sewerage for 337 days over an unnecessarily large space, whilst on the 28 days it would be considerably diluted, and the storm overflows into the river would on some portion of those days necessarily come into action at higher points in the river.

Since September last, when I prepared a design for carrying the lower portion of the outfall sewer on the north side of the Thames in a direct route, across the mouth of Dagenham Gulf, to point B, I have ascertained that a company has been formed, and an act obtained last year, for the conversion of this gulf into a dock, and it is stated that preparations are now being made to effect that object. I have now, therefore, diverted the northern outfall sewer round the north side of the gulf, instead of across its entrance. This alteration has somewhat increased the length, diminished the fall, and necessitated a corresponding enlargement of the sewers, which, coupled with the deepening of the reservoir, has increased the estimate beyond what is due to an extension from point B to B*.

The drainage from the high and middle level areas on the north sides of the Thames would still be discharged by gravitation, and the lifts and pumping power already provided on both sides of the river would remain the same as originally designed for discharging at point A.

The total estimate for the metropolitan drainage, as now designed, will be £2,836,600. I have the honour to be, gentlemen, your obedient servant,

J. W. Bazalgette, Engineer.

APPENDIX.

Table showing the Number of Days in each Month upon which the following Quantities of Rain fell:—

1855.	From 0 to 1-10.	From 1-10 to 2-10.	From 2-10 to 3-10.	From 3-10 to 4-10.	From 4-10 to 5-10.	Above ½ in.	Dry Days.
January	14	—	—	—	—	—	17
February	14	2	—	—	—	—	12
March	6	6	—	—	—	—	19
April	9	—	—	—	—	—	21
May	5	2	—	3	—	—	21
June	7	3	—	1	—	—	19
July	2	4	3	4	—	3	15
August	5	2	—	—	1	—	23
September	3	2	—	—	1·	—	24
October	16	—	2	1	—	4	8
November	4	—	1	2	—	—	23
December	5	—	—	—	—	2	24
Total	90	21	6	11	2	9	226

Mr. Turner said: In the report just read, the engineer states that "the bottom of the reservoirs would be 2 feet above Ordnance Datum, or at the level of the ebb tide at 2¾ hours after high water; that being the period when the discharge of sewerage into the river would cease." Do I understand that as the tide falls you expect the level of the river and of the water in the reservoir will be the same?

Mr. Bazalgette: The river will be rather below—about six inches.

Mr. Turner: Then the reservoir will not be emptied till a later period?

Mr. Bazalgette: Yes; at the same time. The level of the river at 2¾ hours after high water is 1·5 above Ordnance Datum; the level of the reservoir is 2 feet. This is the mean level at Deptford Creek; and I have ascertained that it is sufficiently exact for point B* as to show that the reservoir will empty itself of water.

Mr. Doulton: Supposing at some future time it should be required to extend the sewerage to Sea Reach, is your plan adapted for that purpose?

Mr. Bazalgette: No; it is not well adapted to an extension from the point of outfall; that is to say, if it was the intention to extend it, it could be more economically done by starting at once from Barking than from B*.

The Chairman: And from Woolwich on the south side?

Mr. Bazalgette: From the points of divergence on either side.

Mr. Turner: How many miles is it from Barking to Rainham Creek? or, rather, how many miles of sewers would be rendered useless by such an extension?

Mr. Bazalgette: About four miles on the north side, and three miles on the south.

Mr. Leslie: And all the reservoirs?

Mr. Bazalgette: Yes, both.

Mr. Hawkes: How do you propose to remove the mud in the reservoirs?

Mr. Bazalgette: I do not think there will be much. It will be a long time before any quantity is collected, because on the south side the reservoir will be supplied by the engines pumping into it, so that there will be a considerable fall to wash away any deposit; and on the north side there is a fall of something like 2 feet, or 2 feet 6 inches, which will carry off the mud. Still, that there will be some mud there is no doubt; and I propose to float barges into the reservoirs to cleanse them when empty, and barge it away.

Mr. Hawkes: Unless the barges are covered, would not that be a very offensive process?

Mr. Bazalgette: They could be covered, but there would be no bad smell, and for this reason:—We are now in the habit of removing the deposit in the sewers, and carting it away in open carts through the streets without any annoyance; and certainly, so far down the river as this outfall is, we could barge it away without its being offensive. The deposit would consist in a great measure of the washings of the roads.

Mr. Hawkes: Will not that portion of it that passes into the river form deposits there?

Mr. Bazalgette: I think not. I have before stated that the velocity of the stream in the sewer which brings down these matters is not so great as the velocity of the stream in the river; and I conceive that the same velocity that brought it down would wash it away.

Mr. Turner: Will the bottom of the reservoir be perfectly level and hard?

Mr. Bazalgette: Slightly sloping and paved

Mr. Dennis: Has your attention been called to the sewer in the Caledonian Road, and to the nature and extent of the deposit in it?

Mr. Bazalgette: It has.

Mr. Dennis: Could you in flushing, concentrate sufficient power at any one point to wash away such a deposit as that?

Mr. Bazalgette: A large portion, certainly. I am not aware that the deposit in sewers is of so very offensive a character. I have travelled through some hundreds of miles of sewers in the metropolis, and have passed some hours at a time in them, and I assure you they are much less offensive than is generally supposed. This arises from the large bodies of water that pass through them.

Mr. Few: If an extension to a point lower down the river should be afterwards thought desirable, would not the outfall at B* serve as a storm overflow?

Mr. Bazalgette: Yes; it might be turned to account in that way. It might be considered desirable only to take the actual sewerage on the 260 days in every year, and in that case the reservoirs would do for the rest.

Mr. Hows: A considerable portion of this sewer would be above ground. Can you point to any experiment of the kind already made, or is this something as yet untried? I see that for a considerable length it is raised nearly 20 feet.

Mr. Bazalgette: It is not an untried thing.

Mr. Hows: Is there anything the board can have access to, to show what would be the effect of the summer heat and of the winter's frost upon such a work?

Mr. Bazalgette: I am glad you have called my attention to this point, because it is worthy of consideration. The thing has been tried before; there are very few canals existing which have not iron troughs similar to this, except that they are not covered at the top, for carrying the waters over valleys, or roads, or something of the sort; and I am not aware that in any of those cases mischief has ever arisen. It is looked upon as a common arrangement of construction in these times; the only novelty about this one is, that it will be covered. Two or three objections have been raised to this aqueduct. One is, that it will be affected by the heat and cold of the weather; but provision is made in all these constructions for such contingencies by placing an elastic substance or packing between the joints of the tubes, which allows for the natural expansion and contraction of the metal. The next objection is, that the sewerage, in passing through, would freeze and burst the aqueduct. Now, we all know that sewerage water underground is much warmer than the atmosphere above, and it would be pumped into the aqueduct in that warm state at the River Lea. It would occupy, in flowing from one end to another, four hours; and I am not aware that we have ever had in this country such an extreme frost as would freeze a stream flowing at the rate of two miles an hour in that space of time. Another objection to this aqueduct is, that it is flat-bottomed; and I assume that this means to say, it would collect deposits. Now, the object in having sewers of a circular form at the bottom is, because the quantity of water passing through them is variable. At one time they may be nearly full, and another nearly empty. When the latter was the case, the sewerage spread over the bottom would be so small, that deposits could not be prevented. In ordinary sewers, it is of great importance to keep up the hydraulic depth; but this aqueduct is of a totally different character, and will not be subjected to the passing of unequal quantities through it. It is not intended to take heavy stormwaters at one time, and small quantities of sewerage at another, but will always have a large body of water flowing through it. As there will be two or three tubes side by side, when the quantity to be discharged is small, it can all be sent down one side, and thus flush the sewer; and, as the quantity increases, the others can be brought into use. There is no likelihood of deposits taking place; but, supposing they should, nothing could be more advantageous than the position and construction of these sewers for being cleansed, as all the sewerage could be turned into one or other of the compartments while the one in which the deposit had collected was cleared out.

Mr. Hows: On a former occasion you said that plan *B* was capable of extension. In what particulars does this plan B* differ, that you now say it could not be extended?

Mr. Bazalgette: It is capable of extension from the straight line. The length from the point of divergence would be thrown away. I would just say that there has been one other objection raised to my aqueduct, viz., that a portion of it is level. With regard to that level, I may state that it is necessarily constructed so, and that the length of it is a mile and a half. But I anticipate no difficulty there; because, as it will be perceived, it is so placed that, when the sewers that feed it are full, it will be acting under a pressure, and will have a head of two or three feet, which will keep up a constant flow through it.

Mr. Wilkinson: There is another objection. It is proposed that the aqueduct shall be of iron. Has your attention been called to the chemical effect of sewerage matter upon iron? Would it not have the effect of softening it, and converting it into a substance like plumbago?

Mr. Bazalgette: No; we have had iron used in the construction of sewers for some time; we have also iron penstocks, &c., and they answer very well.

Mr. Leslie: How many feet is the reservoir above the top of the sewer?

Mr. Bazalgette: About three feet at the point of junction. The reservoir, on 226 days in the year, will only be half filled; but then the sewerage matter will on those days rise half way up the sewers. During the remainder of the year it will rise nearly to the top, except on 21 days, when it will rise above.

Mr. Leslie: Are the reservoirs to be flat-bottomed?

Mr. Bazalgette: No; they will be slightly inclined towards the centre.

Mr. Leslie: How many discharge pipes will there be from them?

Mr. Bazalgette: I think about 16 on the north side, and 10 on the south.

Mr. Leslie: Of what diameter?

Mr. Bazalgette: 4 feet. The discharge will be on this principle—that the reservoirs must be emptied in 2¾ hours, with a head of about 4 inches.

Mr. Leslie: In your present report, are the working expenses capitalised or not?

Mr. Bazalgette: They are not. I stated in my first report that the engine power would be the same in either case. The working expenses were capitalised before.

Mr. Leslie: Is it included in the £2,800,000?

Mr. Bazalgette: No; that is the cost of the works.

Mr. Leslie: How much more will it add to that sum?

Mr. Bazalgette: They will be the same as at point A, £27,390, which, capitalised at 5 per cent., would be £547,800.

Mr. Leslie: Does that include the purchase of land?

Mr. Bazalgette: The original estimate includes all expenses. This is the working cost.

Mr. Turner: Will the pipes from the reservoir discharge the sewerage into the middle of the river or at low water?

Mr. Bazalgette: At the level of low water.

Mr. Turner: You intended originally that they should go to the middle of the river?

Mr. Bazalgette: I did, but it only adds to the expense, without any benefit, as at low tide there will be a large head of water above the discharge.

Mr. H. L. TAYLOR: Which would be the most costly, to extend the sewerage from B or B* to the sea?

Mr. BAZALGETTE: From B*—that is to say, the extension itself would cost the same, but £103,000 would have been needlessly spent on the divergence to the latter point.

Mr. LESLIE: "6,000,000 cubic feet in the reservoir" means 6,000,000 when it is full?

Mr. BAZALGETTE: That would be the contents of the reservoir.

M. H. L. TAYLOR: Then, if it should be ultimately determined upon to go to sea, it would be cheaper at present to stop at B?

Mr. BAZALGETTE: Yes, it would be.

Mr. WILKINSON: Apart from the requirements of the act of Parliament, is it your opinion that B* presents greater advantages than B?

Mr. BAZALGETTE: The advantage is in favour of B.

Mr. WILKINSON: That is your opinion, notwithstanding Captain Burstall's report?

Mr. BAZALGETTE: Yes, it is.

Mr. WARE: In the event of this board or of the Government resolving upon trying the effect of deodorising works, could they be established at this point?

Mr. BAZALGETTE: Undoubtedly.

Mr LESLIE said, he was now about to show that the plan just presented was commenced in error, that it progressed in error, and that it terminated in error. It was divided into two parts; and, as the portion up to the East and West India Docks on the one side, and Plumstead on the other, was based on one calculation, he would address himself to that point first. It appeared that all the pumping establishments, and the sizes of all the sewers on both sides of the river, had been framed upon a calculation that they would discharge 51,892 cubic feet per minute—*i. e.*, on the north side, 17,448 cubic feet of sewerage, and 17,845 cubic feet of rain-water; and on the south side, 8020 cubic feet of sewerage. and 8,579 cubic feet of rain-water—making a total of 25,468 cubic feet of sewerage, and 26,424 of rain-water. This was the data upon which the whole system westward of the points he had named was based. But this morning they had heard that the reservoir on the north side was to be fed at the rate of 6250 cubic feet per minute, and that on the south at 2257, being 8507 cubic feet, instead of 51,892. There was the first great error; for there was not the slightest necessity for these enormous works, and corresponding enormous expense. And this primary error governed the whole affair. But, he asserted, that not only did the plan commence in error, but it progressed in the same way, for it contemplated dividing the metropolis into two parts, north and south, instead of treating it as a whole. Now, the 170th section of the act prevented the board taxing any district for the construction of works from which it derived no benefit; and the effect of dividing the metropolis, as this plan proposed, would be to cast the whole expense of draining the south side of the Thames upon the Surrey and Kent districts, as the Middlesex district, deriving no benefit from it, could not be called on to contribute towards it. He, as an inhabitant of the Middlesex side of the river, had no right to object to that arrangement personally, but he thought it was a question which ought to attract the attention of the members for the other side. It concerned them vitally, because in Surrey and Kent there were 45,400 acres of drainage, while in Middlesex there were but 32,000; in the former the population was but 616,000 in round numbers, while in the latter it was 1,745,000. The rental on the Surrey side was £2,257,000, but on the Middlesex side it was £9,000,000. So that it would make an enormous difference in the burden of taxation, if his reading of the act of Parliament were the correct one. On the Surrey side there were but 13 inhabitants to the acre; on the Middlesex side, 54.

The CHAIRMAN: The act of Parliament has fixed the mode of rating, and says what property is to be taxed.

Mr. LESLIE believed that, where no benefit was received, no assessment could be made; and, as the Surrey and Kent side were by the present plan altogther disconnected with the sewerage works proposed on the Middlesex and Essex shore, they could not be called on to contribute to the cost of construction. But, if the board adopted a plan by which the two-tunnel sewers could be connected, and the sewerage of both sides carried down together, the whole metropolis would be benefited by the one work, and could be taxed as a whole for the purpose.

Mr. H. L. TAYLOR asked what motion the honourable member intended to propose?

Mr. LESLIE was not going to fight under false colours. He intended to propose that the engineer's report be rejected.

Mr. WARE thought, as a point of order, it was incompetent to do that.

The CHAIRMAN decided that Mr. Leslie was in order.

Mr. LESLIE said he would now show the ground-work of his objection to the report presented that day, which report referred to the extension from the junction of the high and middle-level sewer, and the East and West India Docks. It started with 200 feet of 9½-feet double-barrel sewer, which was followed by 1050 feet run of double-line cast-iron aqueduct, raised above the ground 17 feet. Then they had 150 feet of 9-feet by 8-feet double-line wrought-iron aqueduct, having a head-way of 9 feet above Trinity high-water mark, so as to preserve the navigation of the Lea. Then came 5000 feet of 9-feet by 8-feet double-line raised cast-iron aqueduct——

Mr. CARPMAEL rose to order. The report brought up to-day did not take in anything west of the point of divergence, caused by the creation of the new dock at Dagenham Gulf on the north side, and from Plumstead on the south.

The CHAIRMAN said, until the board had reversed their former decision, when point B was adopted, it was not competent for Mr. Leslie to travel beyond the distance from B to B*.

Mr. LESLIE: Am I not at liberty to discuss the question in all its bearings?

The CHAIRMAN: You see that up to B the board have already determined.

Mr. LESLIE: And the Government have rejected.

The CHAIRMAN: From B to B* the Government have not expressed their decision, and between these two points the honourable member may oscillate. There is a notice of motion on the *agenda* to revoke the resolution as to plan B; if that should be carried, you can discuss the whole plan, but not till then.

Mr. LESLIE: But Mr. Bazalgette, in his present report, has added a fourth line of iron aqueduct, upon which his plan depends, because he has been obliged to go round Dagenham Gulf on account of some act of Parliament. This makes the line longer, and creates a great alteration in the plan; for the fall is diminished, the size of the sewer is increased, and the reservoir is deepened.

The CHAIRMAN: On every new point you have a right to comment.

Mr. LESLIE said the engineer, in answer to a question, had stated that a mile and a half of this aqueduct sewer was on a dead level. After they had got past that, there was 5230 feet of 9-feet by 8-feet raised cast-iron aqueduct, in quadruple line, which the board had heard nothing about before, to carry away that which, as he believed, one 10-feet brick barrel sewer, half full, would do. The next point was that there were 7700 feet run of 9 feet 6 inches of quadruple line of barrel sewer; and in this length there were lanes to be crossed, and ditches lowered. Then they came to 3570 feet of 8-feet by 8-feet cast-iron aqueduct, quadruple line, followed by 900 feet of 8-feet by 6-feet *triple* line—the four sewers here discharging into three. The continuation was 3220 feet of 8-feet barrel triple line; and then they come to the crowning effort, which brought them down to the reservoir, viz., 22,250 feet of 8-feet by 6-feet 3-inches flat-bottomed cast-iron pipe, triple line, and all out of the ground. He (Mr. Leslie) told the board at the beginning of the year that the difficulties on the northern side were enormous; and those difficulties had been increased, and the expenses increased, by the board persisting in going east of the Lea with these works. They could construct their sewers to be far more effectual and more economical by crossing the river three times, and carrying their sewers down the Surrey side with immense advantage to the parishes and districts on that shore, while they would be enabled to apportion the whole cost upon the entire metropolitan area. The total length of the plan now before them was 9 miles 2050 feet, and it amounted, before the extension to B, in Mr. Bazalgette's own writing, to £750,000; but, as he (Mr. Leslie) believed, it would amount to a million of money. Was not this a question upon which they ought seriously to deliberate? Then, as to the question of the proposed reservoir. Diminished as it was from the one originally designed, and which was to cover 30 acres, it was still such a monstrous nuisance that he was sure, under the act of Parliament, they must not construct it. What was the nuisance of the much smaller reservoirs of the same kind—the King's Scholar Pond, the Ranelagh, and the Counter's Creek sewers? Why, one of the earliest acts of this board was to order some 3000 feet of the former to be cleansed, at a cost of upwards of £400. And what was the operation? To take up out of that sewer about 1750 cubic feet of foul abomination, which, under a proper system of sewerage, would never have been there.

The CHAIRMAN: You ought to state the fact, that this particular sewer is one of the open ditches.

Mr. LESLIE replied, it was covered in, with the exception of about 4000 near the gas-works.

The CHAIRMAN: And as it was that 4000 feet, that needed cleansing, you should have said so.

Mr. LESLIE said the old Westminster Commission of Sewers abolished, years ago, the nuisance of carting away the filthy deposits raised from the sewers. (Question, question.) He considered it was the question, because he was going to show that, if a sewer under ordinary circumstances had such an enormous deposit in it, and required periodical cleansing, the reservoirs proposed to be constructed on the same principle would be much worse nuisances, inasmuch as they would be much larger in extent, and equally tide-locked. [The honourable member proceeded, amidst much interruption, to read and comment upon a report which he had procured as to the condition of the several sewers above referred to, and which, he contended, presented features analogous to those which would be developed under the engineer's present plan of interception.] He concluded by moving, "That, on the ground of the expense of making long lines of flat-bottomed sewers out of the ground, and that the reservoirs of ten acres on the north, and four and a half acres on the south, to pond back the sewerage for eight hours in every tide, are contrary to the act, the engineer's report, dated the 1st of December, and received to-day, be rejected."

Mr. DENNIS seconded the motion. He thought the board ought at once to adopt a bold and manly course, and go direct to the sea.

Major LYON said some of the statements made by Mr. Leslie involved such grave considerations, that he was desirous of putting a question or two to the engineer upon them. The first statement he made was, that the engineer had proposed four tunnels, whereas one of the same size, or a little larger, would do as well.

Mr. LESLIE: Yes, with a proper inclination.

Mr. BAZALGETTE: I answer at once, that undoubtedly it would not be large enough. These tunnels are not at all too large, and they are all in direct proportion and form one consistent scheme. The mode of determining the size of the sewers is well understood among engineers, and I reply most distinctly that these are correctly estimated.

Major LYON: The second question is very important; it is with regard to the King's Scholar Pond sewer, or rather reservoir, as it is described as being similar to the one at B*, and as liable to be filled up with deposit, and require constant cleansing.

Mr. BAZALGETTE: There is a vast deal of difference between the two; in fact, they afford strong contrasts. The King's Scholar Pond sewer is an open ditch in the metropolis, which, as Mr. Leslie has stated in quoting from the report, is closed for 21 hours out of the 24. But that sewer was cleansed in 1849, and did not require the same operation again till last year; so that for six years a sewer, which is tide-locked to the greatest possible extent, was no cost to the metropolis in that respect. The reservoir, on the contrary, is covered over, and far removed from London. The two things do not bear comparison for a moment. The King's Scholar Pond sewer is so low that it cannot get flushed; in fact, the waters that ordinarily come into it can barely get away, and sometimes they do not; but from the reservoir, the level of which is above half tide, the waters will get away freely, and go into the river with a scouring power sufficient to remove all deposits, which cannot be done in a tide-locked sewer.

Major LYON: I was going to ask the difference between the time of the two being tide-locked, but that is sufficiently answered; my last question, therefore, will be—if, as it is stated, there will be miles of flat-bottomed sewers perfectly level, how do you propose to cleanse them?

Mr. BAZALGETTE: It is not so; there is but a mile and a half level, and that part so situated that when the sewers at the high-level and middle-level, which run into it, are discharging, it will be under a pressure of 2 feet, which will give it a velocity equal to the flow into and from it.

The question was then put and a division taken, when there appeared—

For the motion	4
Against it..	23
Majority	—19

Mr. CARPMAEL rose to move the revocation of the resolution of the board on the 22nd of October, adopting the outfall at point B; but, a technical objection being taken by Mr. HAWKES,

The CHAIRMAN said the act of Parliament required two clear days' notice to be given to each member before an order of the board could be revoked.

The debate was therefore adjourned, and the proceedings closed.

THURSDAY, DEC. 4.

DEPUTATION TO THE CHANCELLOR OF THE EXCHEQUER.

A deputation from the Metropolitan Board of Works had an interview with the Chancellor of the Exchequer this day, at his official residence in Downing Street, on the mode of raising the necessary funds for the execution of the main intercepting drainage works, and on the subject of the borrowing powers

of the board. The deputation consisted of Mr. Thwaites (chairman of the board), Mr. Dalton, Mr. Ware, Mr. Offor, Mr. Deputy Harrison, Mr. Boyson, Mr. Savage, Mr. Crellin, and Major Lyon (members of the finance committee), and Mr. Woolrych (clerk of the board). The Chancellor of the Exchequer was attended by Sir B. Hall, her Majesty's First Commissioner of Works, &c.

Mr. THWAITES said the deputation had waited upon Sir George a second time, and they trusted that the urgency of the case they were about to submit would be a sufficient apology. The board felt very anxious respecting their borrowing powers, upon which depended so materially the carrying out of the large works which the act of Parliament had imposed upon them. On the former occasion, he pointed out to the Chancellor of the Exchequer that the Metropolis Local Management Act limited the borrowing powers of the board to the ordinary mode of raising a loan on mortgage of the rates, the effect of which was that they would be obliged to have recourse to the insurance offices. A difficulty, however, had arisen, as many of these offices were, by their deeds of settlement, unable to advance money on other than real or government security. The sum also that the board would require for the purposes of the act was so large, that they had no prospect of being able to raise it in that quarter, or, if they did, it would be at a charge for interest very prejudicial to the ratepayers of the metropolis; under those circumstances, they felt themselves compelled to use their best endeavours to improve the borrowing powers conferred upon them. There were powers, it was true, given to the Government Commissioners, under the 14 and 15 Vic., c. 23, to advance money for public works; but he need not tell Sir George that their loans were limited to a sum of £90,000 per quarter, or £360,000 per annum; and, therefore, that the board could entertain no hope of relief from that source. He had before taken the liberty of stating it as his opinion that the Government ought to contribute from the national funds towards the large structural works which they had to effect in the metropolis, independently of any assistance which they could afford in enlarging the borrowing powers of the board. That was a question upon which, personally, he had a very strong feeling, believing that the works referred to partook of a national, and not merely a metropolitan, character. There were many reasons, which he would not recapitulate, why he thought the Government should contribute to these works. Setting that question aside, however, for the moment, the board, in the position in which they found themselves, thought it was the duty of the Government to render them some assistance in improving their borrowing powers, or by advancing them such a sum of money as they might require, taking as security for repayment a charge upon the rates of the metropolis. That security was, beyond all question, amply sufficient for all the purposes the Goverment might demand. The sum that the board would in all probability require for drainage purposes, and for the payment of the debts and liabilities of the late commissioners, as also for other purposes, of a metropolitan character, would amount to £4,000,000 sterling. It had struck his own mind that, if the Government were prepared to borrow that sum, and advance it to the board—say in the proportion of £1,000,000 a year for four years, and spreading the repayment of it over a period of fifty years, taking the security of the rates—it would enable them to carry out the great work of intercepting drainage, to pay off the liabilities of the late commissioners, and to effect some of the more pressing metropolitan improvements which were demanded at the present moment. The drainage works were, the board considered, the most important works committed to their charge, and required their immediate attention; but he might state that they were very strongly urged by the public to take up the question of the formation of parks. It was the opinion of many persons who had directed attention to the subject, that, with the rapid growth of London, the constant addition of houses and streets which was being made in every direction, and the large increase yearly taking place in the population, unless some means were adopted to secure public parks and places of recreation, the health of the inhabitants of this great City must in the course of a few years suffer most materially. For himself, he was convinced that it was the duty of the board to provide these parks, and on the score of economy he felt that the matter should not be delayed, because the ground in the suburbs which was now available for such purposes, would in a short time be built over, and then the cost would be such as to render it almost impossible to entertain the subject at all. These matters had pressed upon the attention of the board; and, while there was an anxious wish on their part to carry out such improvements for the benefit of the metropolis, they felt that with the limited means at their disposal, and having to complete the intercepting drainage works within the time prescribed by the act, viz., between now and the year 1860, it was their duty to turn their attention first to this subject, and to obtain on as economical terms as possible the moneys necessary for the purpose. But it was evident that, if the board were at once to carry out these very necessary improvements, they must have the assistance of the Government; because, however anxious they might be for the health of the inhabitants, they could never attempt to tax them at the rate of £1,000,000 per annum. It was desirable, too, that the amount so borrowed should be spread over as large a space as possible, so that the present ratepayers should not have to bear the whole cost of works which future generations would share the benefit of. He had made a calculation that, if the Government were prepared to accede to the wish of the board, and lend them the sum of £4,000,000, in four yearly instalments, spreading the repayment over 50 years, that, taking the present rateable value of property in the metropolis at £11,150,000—and he need not say was increasing at the rate of £300,000 to £400,000 per annum—a rate of 3⅜d. in the pound would be sufficient to pay the interest and principle in the time he had named.

The CHANCELLOR of the EXCHEQUER: The £11,150,000 is the rateable value of the property in the area over which your board extends?

Mr. THWAITES: It is.

The CHANCELLOR of the EXCHEQUER: How much does a rate of 1d. in the pound raise?

Mr. THWAITES: In round numbers, about £50,000.

The CHANCELLOR of the EXCHEQUER: You speak of £4,000,000. Do you contemplate the Government lending you the money at a certain rate of interest, or guaranteeing a loan raised by yourselves?

Mr. THWAITES: That is a question in which the board would defer to the opinion of the Government.

The CHANCELLOR of the EXCHEQUER: At what rate of interest?

Mr. THWAITES: We apprehend that the Government would raise the money upon the best terms possible, taking the security of our rates, and fortifying themselves by a clause in the act, giving them power to ensure the repayments as they fall due. We consider that the Government would lend to us at the same rate at which they borrow.

The CHANCELLOR of the EXCHEQUER: That is not the practice of the Government with regard to advances made for public works. As a rule, they take 5 per cent.; in some cases, however, it is reduced to 4 per cent.

Mr. THWAITES: We think that we have a claim of a rather stronger character than ordinary. Waiving the question of whether we ought to expect from the Government a contribution to works which are semi-national, we think they ought to give us their credit to enable us to raise the money; and we also think that we ought to have the advantage of the same terms as those on which the Government could borrow.

The CHANCELLOR of the EXCHEQUER: What expenses would you defray besides the main drainage?

Mr. THWAITES: There are about £400,000 or £500,000 of the debts and liabilities of the late commissioners, a portion of which sum is of very long standing, and was handed over to our predecessors by the several commissioners when the consolidation took place in 1848.

The CHANCELLOR of the EXCHEQUER: How much do you allow for the drainage scheme?

Mr. THWAITES: About £3,000,000.

The CHANCELLOR of the EXCHEQUER: You think that will be sufficient?

Mr. THWAITES: Yes; as far as we are concerned.

The CHANCELLOR of the EXCHEQUER: And how much for parks and other improvements?

Mr. THWAITES: We have to raise about £600,000 for the new street in Southwark, to construct which we have given the requisite parliamentary notices, and £500,000 for parks.

The CHANCELLOR of the EXCHEQUER: How do you raise the money for the new street?

Mr. THWAITES: In the first place by a loan, and afterwards by the sale of ground-rents. It will also be diminished by the money already in the hands of the Government for the purpose.

Sir BENJAMIN HALL: There is a large sum in my hands, as Commissioner of Works, for that purpose—about £90,000.

The CHANCELLOR of the EXCHEQUER: But there is a great difference between that and the actual cost. Do you think that under the power of your act you can raise £500,000?

Mr. THWAITES: I question very much whether we can; but we take powers in the bill of which we have given notice.

The CHANCELLOR of the EXCHEQUER: You do not make that a part of the £4,000,000?

Mr. THWAITES: We take the £500,000, which will give us a margin for the purpose of dealing with the question of parks and new streets.

The CHANCELLOR of the EXCHEQUER: What will the net cost of the new street be?

Mr. WOOLRYCH: About £300,000—I may say, that towards meeting the liabilities of the old commission there is £100,000 in hand.

The CHANCELLOR of the EXCHEQUER: You reckon upon paying off the £4,000,000 in fifty years, or a fiftieth part each year; that would be £200,000 a year for the sinking fund and interest.

Mr. THWAITES: It would be an equalised payment of principle and interest in the form of an annuity.

The CHANCELLOR of the EXCHEQUER: Do you reckon that you could raise £200,000 a year as a sinking fund and interest?

Mr. THWAITES: It would not be so much as that. If borrowed at 3¼ per cent. we should have to raise £162,998.

The CHANCELLOR of the EXCHEQUER: You say that the rates would be excellent security. There is no doubt as to the property of London being adequate security; but one must look not merely to the property, but to the means you have of levying taxes upon it. Supposing that the great drainage works were executed, and the people of London were disappointed at the result, the board which they elect some five or ten years hence would take quite a different view of the policy of the plan you have adopted. They might consider it quite an improper expenditure, and that the town had not had the value of the outlay. Acting from such a conviction, they might refuse to make a rate to pay the interest of this loan. In what position would the Government then be placed?

Mr. THWAITES: I apprehend the Government would take powers in the bill introduced into Parliament to enable them to borrow and lend, under which powers they could collect the rate.

The CHANCELLOR of the EXCHEQUER: Would you put the Government into a position to tax the town?

Mr. THWAITES: I apprehend that our successors would be compellable, under *mandamus*, to make a rate.

The CHANCELLOR of the EXCHEQUER: That, no doubt, would be the process. If the board refused to make a rate of £200,000, interest and sinking-fund, the Government would have to go into the Queen's Bench. But the possibility of such a course would very much invalidate the security.

Sir B. HALL: You know there is very nearly the same thing in operation now.

Mr. THWAITES: There could not be the slightest objection on the part of our board to the insertion of any clause in the bill which the Government might think necessary to increase the security; nor is there the slightest idea of repudiation by us or any future board.

The CHANCELLOR of the EXCHEQUER: The Government is in the habit of lending money to public bodies—and I am not urging anything to the effect that your board will not keep faith—but it is necessary to look at every possible contingency when we are examining the value of a security. I say the Government is in the habit of lending money to public bodies, such as to county magistrates and board of guardians; but the sums are generally small sums, such as £50,000, and at the outside £100,000. The object of such loans is for manifealy useful purposes. There can be no great difference of opinion as to the necessity of constructing prisons, lunatic asylums, or workhouses; and no objection can arise as to the repayment of £4000 or £5000, which sums comprise interest and sinking fund; but, when it comes to be a question of millions advanced to municipal body, of course the danger of a change of public opinion is greater; and it is necessary to look more thoroughly into the validity of the security.

Mr. THWAITES:—But still, Sir George, you must bear in mind that the counties borrowing money for county purposes, and repaying the loan by instalments of £4000 or £5000 a year, is as large in proportion as what we are asking. From the great value of the property we have to tax, it will only require a rate of 3⅜d. in the pound, to repay principal and interest of this loan; and that is not more in proportion than the counties levy for the purpose of paying the smaller sums they borrow. I cannot conceive it possible that such a spirit would ever seize the ratepayers of London, as that they would repudiate a debt honourably contracted and usefully employed.

The CHANCELLOR of the EXCHEQUER: That is a point upon which a difference of opinion might arise.

Mr. THWAITES: In reference to the main drainage, which is the principal item of expenditure, that is a question not merely for the board to determine, but one in which the Government have a veto; and we understand that the First Commissioner intends to refer our plans to engineers in whom he has confidence, to determine whether they are suitable for the object contemplated. The Government, therefore, have a kind of supervision of the works we are constructing; and there can be no objection whatever, as those works progress and the annual payments of the proposed loan are required, that certificates should be obtained and every information afforded, so as to satisfy the Government thereon.

The CHANCELLOR of the EXCHEQUER: It is not so much a question as to the satisfaction of the Government, as of the manner in which the result would be viewed by the public opinion of the metropolis some years hence. Upon that state of feeling the validity of the security might to some extent depend; and I wish to point out to you that this is a consideration.

Mr. THWAITES: Parliament has already determined the question, and the Metropolitan Board of Works has been constituted on the recommendation of the Government to carry it out. The particular kind of works which we have to execute are defined by the act, and the whole subject has been investigated by repeated committees of the House. It is not a new thing whether London shall be drained or not, or of any particular way in which it shall be done; the whole thing has been properly sifted, the public mind is made up for it, and a great desire is expressed to see it commenced.

The CHANCELLOR of the EXCHEQUER: Supposing that this loan were effected, and your finances were burdened with an annual rate for its repayment during the next fifty years, what other expenses do you contemplate the board would incur? Of course there are your current expenses, and this would be a dead weight upon you. Can you form any idea of what your total demand upon the ratepayers would be?

Mr. THWAITES: The late Commissioners of Sewers have been in the habit of levying a rate of 6d. in the pound.

The CHANCELLOR of the EXCHEQUER: And have accumulated a debt of half a million.

Mr. THWAITES: If we confine ourselves to that limit, we should still have £150,000 a year (beyond this dead weight) for metropolitan purposes.

Sir B. HALL: The Chancellor of the Exchequer should be informed, that when the Metropolitan Commissioners of Sewers levied a rate of 6d. in the pound, it was for a vast amount of works that do not come under the cognizance of your board at all; because, before the Metropolis Local Management Act, they had the whole of the drainage under their control, and subject to their expenditure; whereas this board have nothing of the kind, the district authorities having the district sewers under their management. The expense, therefore, is very much diminished, because only a few sewers, comparatively, are under your board.

The CHANCELLOR of the EXCHEQUER: You have an establishment; what is the cost of that?

Mr. WOOLRYCH: About £22,000, including compensations.

The CHANCELLOR of the EXCHEQUER: Do you think that a 6d. rate would be sufficient to cover all these expenses?

Mr. WOOLRYCH: All that are at present contemplated.

The CHANCELLOR of the EXCHEQUER: What I want to get at is this—what will be the total poundage of the rates you will levy in the course of a year for all purposes whatever, including the interest on this loan and the sinking fund?

Mr. THWAITES: That is a difficult question to answer, and would entirely depend upon the nature of the improvements we carry out. We may have a street to construct which will cost £500,000, or only £40,000.

The CHANCELLOR of the EXCHEQUER: If you only raise 6d. in the pound it would give you but a narrow margin for improvements.

Mr. THWAITES: I do not apprehend that it would be sufficient. I was only showing that, in addition to repaying the loan and interest, we should have £150,000 for other improvements, if we only taxed at the rate of the old commissioners.

The CHANCELLOR of the EXCHEQUER: That was a tax actually borne and paid; and the area of the late commissioners was not so extended as yours.

Mr. THWAITES: Yes; they went beyond us in some cases; for instance, they included Richmond, Hornsea and other places, which are cut off now. As far as the sewerage works to be executed by local boards are concerned, they will be completed in a few years, and will require afterwards only a small annual outlay, and the principal charge made by our board will be for the metropolitan improvements. No doubt additions will have to be made to our sewerage works, but, practically, our rates will be levied for opening up new streets.

The CHANCELLOR of the EXCHEQUER: I quite understand your proposition now, as you have explained it very clearly. Of course, nothing can be done, assuming that your proposition was acted upon, by the Government with its present powers. It would be necessary to go to Parliament.

Deputy HARRISON: We are preparing a bill for certain improvements in Southwark, and we could insert the necessary clauses in it for the purpose.

The CHANCELLOR of the EXCHEQUER: That is a private bill.

Mr. THWAITES: It has reference to a local improvement in Southwark. It is of very little consequence to us whether the borrowing powers are incorporated in that or not.

Deputy HARRISON: But we must make some provision in that bill for raising the necessary funds for that improvement.

The CHANCELLOR of the EXCHEQUER: It must be done by an alteration of your general act.

Sir B. HALL: No; I do not think that is necessary.

After some further conversation,

The CHANCELLOR of the EXCHEQUER said, I will consider this matter during the recess, and when Parliament meets, will let you know.

Mr. THWAITES: The matter is very pressing, so far as we are concerned. We are preparing extensive works, and cannot see our way to carry them out unless the Government will assist us.

The CHANCELLOR of the EXCHEQUER: The Government have no power to contract a loan on their own authority. In every case they obtain the sanction of Parliament, and the money which they can lend for public works is limited by act of Parliament. Therefore, nothing can be done till Parliament meets.

In reference to a remark by Mr. BOYSON,

The CHANCELLOR of the EXCHEQUER said: I do not say that your request is an unreasonable one; but there is a general wish on the part of persons executing public works to have the guarantee of the Government, as it enables them to borrow on more advantageous terms. Many such applications are made which are refused, but your argument is, that yours is an exception to the general rule.

Mr. SAVAGE: We are not like a public company; we are a body elected for the purpose of carrying out great works.

Major LYON: We are an entirely elective board, so that we think we have a greater claim upon the public than the former commissioners, who were wholly or partially nominated by the Government.

The CHANCELLOR of the EXCHEQUER: That argument, no doubt, is correct; but, on that very ground, the views of the board are liable to change, inasmuch as from time to time they will reflect the views of their constituents. The general public feeling in the metropolis may undergo an entire revolution.

Mr. THWAITES: One almost feels that it is a libel upon the English character, to suppose it possible that a debt of this kind should be repudiated. I have never heard or read of such a thing.

The CHANCELLOR of the EXCHEQUER: I do not think it a probable event. At the same time it is conceivable that such a case should occur.

After some remarks by Messrs. Crellin and Boyson,

The CHANCELLOR of the EXCHEQUER said: Mr. Thwaites, perhaps the best mode will be for you to put your proposition in writing, just giving me the substance of what you have stated to-day, and what it is your wish the Government should do—the object of the loan, and the manner in which you propose the repayment of the money.

The deputation, having thanked the Chancellor of the Exchequer, then retired.

FRIDAY, DEC. 5.

The Ordinary Weekly Meeting of the Board was held this day at Guildhall—Mr. THWAITES in the chair.

Mr. J. Rashleigh took his seat at the board as member for St. Pancras, in the place of Mr. Corrie, resigned.

The minutes having been read and approved, the board proceeded to consider several awards of compensation for loss of office by the vestry of St. George's, Hanover Square.

The CLERK said that, in accordance with the directions of the board, the opinion of the late Attorney-General had been taken on the following point: viz., whether awards of compensation to persons formerly engaged under paving and other boards, who had received appointments by vestries and districts under the new act, were legal, when such compensations were to take effect at a future period, viz., on the parties being discharged from their present employment. Sir A. E. Cockburn's opinion was, that vestries could not award compensation in that manner, and that the compensations under the act must be awarded *in presenti*.

The cases from St. George's, being of this character, were therefore dismissed.

A number of reports by the engineer and superintending architect, on local matters, were read and disposed of.

The opinions of counsel on the question of compensation, and also as to the extent of the powers of this board under section 49, Metropolitan Building Act, with respect to altering the fees payable to district surveyors in respect of the matters specified in the second schedule to the act, were ordered to be printed.

On the motion of Mr. COLLINSON, Mr. H. L. Taylor was nominated on the the committee of works and improvements, in place of Mr. Hall, deceased.

Mr. SAVAGE moved, "That no motion, amendment, or proposition, shall stop the usual course of discussion upon any question under the consideration of the board, except it be a motion in the words, or to the effect—'That this board do now adjourn.'" After some discussion, the matter was referred to the bye-laws committee, on an amendment by Mr. RASHLEIGH.

Mr. D'IFFANGER, in the absence of Mr. Bristow, moved "That the clerk be directed to summon the members of the board for twelve o'clock on Tuesday in every week, at the premises in Greek Street, until further notice, for the purpose of considering and determining upon the reports of the superintending architect on applications under the Metropolitan Building Act, and the Metropolis Local Management Act."

The motion was negatived.

Mr. LESLIE presented a plan from Mr. Edward Dike, for collecting the sewerage matter of the metropolis and converting it into a valuable manure.

Mr. CARPMAEL also presented a memorial from Mr. Thomas Morris, architect, Southfield Grange, Wandsworth, on the subject of metropolitan drainage.

Several matters of a routine character having been disposed of, the board adjourned.

GAS LIGHTING IN MARYLEBONE.

At the Meeting of the Representative Council and Vestry of St. Marylebone, on Saturday, the 29th of November—Mr. J. A. NICHOLAY, churchwarden, in the chair—

The first business on the notice-paper was the discussion of a motion of which notice had been given by Mr. Filmer—"That, in consequence of numerous complaints of a deficient supply of gas in various parts of the parish, a competent inspector be appointed, whose duty it will be to report any deficiency in quantity or quality."

Mr. SODEN, in the absence of Mr. Filmer, took up this motion. He expressed his conviction that the complaints which were continually being made as to the lighting of that parish by the Imperial Company were very much exaggerated; but, if the vestry felt that they were true, then let them have a check. The only way this could be done was to carry the resolution which had been brought forward by Mr. Filmer, and which had been on the notice-paper for so many weeks. Let, then, a man who was competent not only test the quantity but also the quality of the gas supplied. This would put an end to these continual complaints, ending in nothing, for they could then have some practical evidence to go upon, which was now not the case. Mr. Soden concluded by moving the resolution.

Mr. GRANGE seconded the resolution. There could be no doubt but the state of the lighting in the district in which he resided was such that some such step as this was required. He thought it would be of the greatest benefit to the parish if they had this gas-lighting inspector appointed. It would effect a vast saving if they gave a man £100 a year to be out all night inspecting the lamps, if they could find a competent man content for that sum to turn night into day; and if they could not, then let them give him a little more. (Hear, hear.)

Mr. BURDEN said he could be bribed. ("Oh, oh!" and "Hear, hear.)

Mr. GRANGE, if they appointed a respectable and a competent man, did not believe anything of the sort. At all events, it was of no use for that vestry to be continually grumbling that they had not the supply of gas for which they paid, without they took some means for accurately testing whether they had the supply contracted for or not. Let them appoint a man who should go out every night and make a report as to the whole of the lamps.

Mr. SALMON: What! one man to walk over, every night, 59 miles of streets? (Hear, hear.)

Mr. GRANGE thought this was the only way to test whether the parish was properly lighted or not. ("Oh, oh!" and "Hear, hear.")

Mr. W. WILLIAMS, M.P., must give his opposition to this resolution. In fact, he would move, as an amendment, that the resolution be discharged from the notice-paper. (Hear, hear.) He thought the vestry might just as well appoint an inspector to inspect every other article with which the parish was supplied, as to inspect the quality of the gas, as well as the quantity, by cursorily walking through the streets at night. He called upon the vestry not to lend itself to the perpetration of this gas-inspector's job. (Cries of "Hear, hear," and "Oh, oh!")

Mr. TAVERNER seconded the amendment. He thought it quite impossible that the services of any one man, to test the lights of a parish like Marylebone, would be of the slightest service. (Hear, hear.)

Mr. HEAD said it was quite certain that something should be done to remedy the evil, as there were lights continually out all over the parish;

and on Wednesday, Thursday, and Friday, in the Greville Road, there were lamps not lighted at all.

Dr. BACHHOFFNER said, with reference to the motion put on the paper by Mr. Filmer, and now taken up by Mr. Soden, he was of opinion that the vestry could not, as a sensible body of men, entertain it. He could assure them that, if they required an officer who was not only to be a night inspector of gaslights, but also to possess sufficient capacity to report to the vestry from time to time as to the quantity, as well as quality, of the gas, he could tell them that they could not expect to get such a person for £100 per annum, as talked of by Mr. Grange. In fact, they must have the services of a gentleman who understood somewhat of chemistry, to make anything like reliable tests as to the quality of the gas; and he could also tell the vestry that it would be required that they should provide an apparatus for the performance of the tests, which would cost about £150. He thought the subject was one which the vestry would not at present be justified in entertaining.

Mr. WINGFIELD considered that the vestry ought to entertain this question, with regard at least to the inspection of the lights, as the police, although it was their duty to report all defective lights, paid no attention to it. Out of the five books kept for the purpose of such reports, there was only one produced and on the table that day; and there were no reports against the lights of that district, whereas they were out in Great Marylebone Street continually.

Mr. GRANGE: And yet you will not have an efficient person as an inspector of the lights, which will save the parish an enormous sum of money every year.

Dr. RUSSELL thought that, if this matter were referred to the paving committee, it would meet all the objects that were required, and that they would take steps to see that the public lighting was properly looked after.

Mr. JACOB BELL said he should like to know when the appointment of new officers would be likely to end? They first commenced with the appointment of an officer of health under the Local Management Act, and it appeared to him that since that time there had been quite a mania come upon the vestry for electing new officers. He could really not understand the necessity of appointing a person to inspect the gaslights. If the lights were bad, the members of that board could see for themselves as well as an inspector. If they dealt with a baker, and that baker sold them bad bread, what did they do? Why they went elsewhere.

Mr. BRIDGMAN: But with regard to gas, we have no other shop to go to.

Mr. WINGFIELD: No; it is a monopoly.

Mr. BELL: Well, then, let the gas be properly tested, both for quantity and quality, by some respectable and duly qualified chemist. (Hear, hear.) If they wished to do any good, they must have a properly qualified man, and let him be properly paid for his services; but do not let them hold forth, as a bait, another permanent appointment, for which they would have up directly a hundred hungry expectants for office. If they referred it to the sanitary committee, or the paving committee, there would be so many conflicting powers that nothing would be done.

Mr. GUY said Mr. Filmer brought forward and carried a motion some time ago, that all the lamps in that parish should be consecutively numbered. Now, if this were done, the police would have no difficulty in making their reports as to the state of the lighting with regard to a particular lamp; but there was a difficulty in identifying a particular lamp, which might have been out all night, without this indication.

Mr. SCAGE, the parish surveyor, said, the person who had the contract for numbering the lamps was now progressing with them, and they would be completed as soon as possible.

Mr. SODEN, in reply, said he could not consent silently to pass over the observation of Mr. Williams, that this proposal was a job. (Hear, hear.) That sort of language might do for the House of Commons, where, no doubt, many glaring jobs were perpetrated—(laughter);—but he was surprised at Mr. Williams, as an old vestryman, using that term there. When it was remembered that the parish of Marylebone paid for its public lights something like £14,000 a year, it was a very important question that they should have their quantity; and it was with a view to secure that, he had moved for the appointment of this inspector It would not only be a satisfaction to the parish, but it would also be an act of justice to the company, who, he firmly believed, were not deserving of half the complaints made against it. It had been charged that in St. John's Wood district there were lamps which did not have lights burning 2½ or 3 feet per hour, instead of 4 feet per hour; but it was shown, on a recent occasion, that there were other lamps which burned more than the quantity, and that the illuminating power of the gas was considerably above the parliamentary standard. So that, if the parish did not have their contract carried out one way, they did in another way. They had inspectors of gas in the City of London, Liverpool, and other large towns, and they did not, in reality, cost anything, in consequence of the services they rendered. Why, therefore, should they not have such an officer in Marylebone? His own opinion was, that the appointment of an efficient man would be not only satisfactory to the parish, but to the company also. (Hear, hear.)

The amendment was carried by a large majority, and the subject terminated.

GAS LIGHTING IN ST. PANCRAS.

A contest, which is likely to prove of a severe and conflicting character, involving, as it will in the course of a short period, the public lighting of the entire parish of St. Pancras, has sprung up between the Imperial and the London Companies, in the tenders which have been put in by them for lighting the two first districts which have come under the control of the vestry by the provisions of the Metropolis Local Management Act.

The subject came before the committee of works on Monday evening, the 1st inst., having been adjourned from the previous meeting for the purpose of enabling the chief surveyor and medical officer of health to test the comparative qualities of the gases of the London and Imperial Companies. The tender of the London Company for a bat's-wing burner, to consume 5 cubic feet of gas per hour, was £4. 14s. 6d. per light per annum; whilst the tender of the Imperial Company was 1s. 6d. per light higher than that of the London Company.

G. A YOUNG, Esq., the chairman of the Board of Works for St. Pancras, presided.

Mr. W. B. SCOTT, the chief surveyor and engineer of the parish, presented and read the following report:—

TO THE HIGHWAY AND PUBLIC WORKS' COMMITTEE.

Gentlemen,—I have to report the steps taken by me, and the results of the inquiries made respecting the comparative illuminating power of gas supplied by the Imperial and the London Gaslight Companies, in accordance with the instructions of the committee at its last meeting.

Letters were sent to the chief inspectors of the companies, informing them of the desire of the committee, that myself and Dr. Hillier should test their respective gases; and, it having been mentioned to me that Mr. Pepper, of the Polytechnic Institution, had examined and tested the gases, a letter was written to him, asking to be favoured with the result. To this no answer has been received. I also made inquiries respecting the reports made to the City by Dr. Letheby, but found that his reports did not include either of the companies. In answer to the former letter, a communication was received mid-day Friday, from the inspector to the London Gaslight Company; and the inspector to the Imperial Gaslight Company called in the course of Friday afternoon, offering to give me the required information at any time, as far as his gas was concerned.

I named that evening, at 7·30, and met him (Mr. Hersey) at one of the company's offices, York Place, New Road, at that time, and we there tested the illuminating power of the gas supplied by the Imperial Company—the gas being that manufactured at the King's Cross station. The photometer was enclosed in a dark chamber allotted to the apparatus, all light being excluded but that emitted from the illuminating agents; and the walls, ceiling, &c., were blackened, so as to avoid any diffused or reflected light. In this chamber daily observations are taken by the company's officials, and registered. The photometrical apparatus consists of a divided bar 100 inches in length, at one end of which a 15-hole Argand burner is fixed; and at the other end, the illuminating agent with which the power of the gas is to be compared—in this case a sperm candle.

The comparison is made by interposing between the two lights a disc of paper, with an annular space made transparent, and surrounding a centre position, which is opaque; and the comparison is not one of shadows, but of transmitted light passing through the transparent surface, with reflected lights striking on the opaque surface. This disc is shifted along the divided bar, until no difference is perceptible between the opaque circle and the transparent annular space which surrounds it. When this condition is obtained, the lights acting on each side of the disc are of equal force, and the comparative illuminating power is in the ratio of the squares of the distance of the illuminating agents from the disc.

The Argand burner having been gauged to consume exactly 5 feet of gas per hour, a sperm candle (six to the pound) was weighed, lighted, and fixed at the end of the beam, and the disc was then shifted till in the condition before described. A reading on the scale was then taken. Whenever the relative power of the lights varied, the disc was shifted, and another reading taken. This continued for exactly ten minutes, during which time 24 readings were taken. At the expiration of the ten minutes, the candle was blown out, and again weighed; 24 grains of sperm had been consumed, being at the rate of 144 grains per hour, showing the Argand burner, consuming 5 cubic feet of gas per hour, to be giving light equal to 14·58 sperm candles, or 17·23 wax candles. The parliamentary standard is, that a 15-hole Argand burner, consuming five cubic feet per hour, shall give light equal to 12 wax candles, burning 120 grains per hour each. Sperm candles are preferred in manipulation, as giving a more steady and uniform light. The results are reduced to the parliamentary standard by simple calculation—the illuminating power of sperm candles being considered, to that of wax candles, as 13 is to 11 by some gas authorities; by others, a 7th part is added to the number of sperm candles to obtain the result in wax. In the experiment just described, the first-named proportion was taken; in the experiment now about to be described, the latter.

On Saturday morning, at eleven o'clock, Dr. Hillier and myself went, by appointment, to the London Gas Company's works, at Vauxhall. We were met by Mr. Jones, the engineer; Mr. Tully, the chief inspector; and by Mr. Warrington, the chemical referee appointed to test the gas supplied by the four companies who supply the metropolis south of the Thames. Mr. Warrington conducted the experiments in a room at the works set apart for him in his official capacity. The apparatus was on the same principle as at the Imperial Company's office; but the room was not blackened, it being papered with a patterned paper. Mr. Warrington did not weigh the candle and take a series of readings, striking an average, and comparing that average with the number of grains consumed, but judged by the appearance of the flame of the candle, when a reading on the scale would give the proper and fair power of the gas. The reading in this case showed 16·5 sperm candles, being equal to 19·8 wax.

Before making the experiments, Mr. W. informed us that the average during the year 1855 was 15½, and during 1856 was 15, wax candles; that he had found the power of the gas as high as 18 candles, and on one occasion as low as 12·5; but that the average was from 14 to 16. I have since received the following letter sent by Mr. Warrington to the secretary of the London Company:—

"*Apothecaries' Hall, London, Nov.* 28, 1856.

"Dear Sir,—The average illuminating power of the gas supplied to the public by the London Gaslight Company, taken at the Vauxhall works, has been found equal to the light of 15·5 wax candles, burning 120 grains per hour, for 1855; and to 15·0 candles for the present year.

"The quality and the illuminating power of the gas is tested weekly, and it has always been found to be free from sulphuretted hydrogen.

"I remain, yours very truly, "ROBERT WARRINGTON.

"J. R. Hinde, Esq."

We subsequently were shown the room in which the engineer to the works (Mr. Jones) tested the power of the gas daily, and he explained that he always weighed the candle before and after the experiments, as I have described as being done by Mr. Hersey.

He stated that his tests showed that the power of the gas was often as high as 16½ and 17; the average being 14 sperm candles, equal to 16 wax.

Before leaving the works, Mr. Berry, a consulting gas engineer, called; and, as he happened to mention that he had examined and contrasted gas supplied by the London, Imperial, and Western Companies, I asked him for a copy of his report on the gases supplied by those companies. He has this morning favoured me with the following letter, in which, however, he speaks only of the one gas, his statements corroborating those of Mr. Warrington:—

"*Berry's Iron, Gas Engineering, Hot Water Apparatus, and Ventilating Works,*
3, Victoria Road Pimlico,
(Manufactory, Albion Works, Wilton Road),
Dec. 1, 1856.

"Sir,—In compliance with your request, I beg to forward to you extracts of my report to the vestry of Kensington:—

"'Feb. 6, 1856.—The illuminating power of the London gas was tested, with the following results:—Argand burner, consuming per hour 5 feet, was equal to 13 candles, consuming 120 grains per hour.

"'Feb. 27.—I again tested the London: Argand burner, consuming 5 feet per hour, was equal to 14 candles.

"'On June 18, 1856, I was engaged by the vestry of St. James, when their gas was equal to 15 candles.

"'On Nov. 18, 1856, I again tested the London gas, when I found it equal to 15 candles.'

"The above are the results of experiments made in my own room, with my private apparatus, from gas supplied by the ordinary street service.

"Yours faithfully, "Z. D. BERRY, Consulting Gas Engineer.

"W. B. Scott, Esq."

"*The Albion Works, Wilton Road, Pimlico,*
Dec. 1, 1856.

"Sir,—On reperusing the copy of my note, I find I omitted to say, that my experiments were with *sperm* candles. The omission arose from its being merely an extract, and in the report the mode of conducting the experiments formed the preface. "Yours faithfully, "Z. D. BERRY.

"W. B. Scott, Esq."

I have thus reported on the means I have been able to adopt to supply the information sought by the committee. The results are stated without bias or partiality; as the observations are but isolated. I would, however, respectfully submit for the consideration of the committee, whether it would not be desirable to have a series of observations made on the comparative illuminating power of the gases before contracts are entered into for the lighting of those parts of the parish where the contracts either have or shortly will expire; and whether clauses should be inserted in the general conditions of the contract, binding the companies to supply gas of a certain power, such series of observations being continuously made during the existence of the contracts, and the results periodically reported to the vestry.

W. B. SCOTT.

Mr. SCOTT, in answer to a question from Dr. Ellis, said, the Imperial Company's officer called on him on the Friday afternoon, and he appointed half-past 7 o'clock that evening for testing their gas.

The CHAIRMAN understood that both were special appointments.

The SURVEYOR said they were.

Dr. ELLIS: Then both companies had the opportunity of cooking their gas.

Mr. SCOTT could not say if that were the case.

Dr. HILLIER thought that it would have been more proper that both tests should have been made without notice. (Hear.)

Dr. HILLIER, the medical officer of health, then read his report, as follows:—

TO THE HIGHWAY, SEWERS, AND PUBLIC WORKS' COMMITTEE.

Monday, Dec. 1, 1856.

Gentlemen,—In accordance with the request forwarded to me by Mr. Scott, on Wednesday last, to examine and report on the relative illuminating power and purity of the gas supplied by the Imperial, and that supplied by the London Company, I have taken such steps as were possible in so short a time, without previous notice, to accomplish that object.

I would state, in the first place, that I do not consider that any results obtained from *our examination* are to be relied on as evidence by which fairly to judge of the quality of gas *commonly* supplied by any company, inasmuch as the quality supplied by the same *company* at *different times* varies very much; so that a long series of experiments are required, extended over some weeks, or even months, of which the mean results should be taken.

In the next place, *no satisfactory* results can be obtained unless an apparatus for the purpose be procured, and fitted up in a room darkened, and used for no other object.

On Friday last, I made an examination of a rough kind of the gas supplied by the two companies, with such apparatus as I had of my own.

I compared the light given by the gas of each company, burnt in the same fish-tail jet, with the light given by a composition candle. The dimentions of the flames were taken as nearly as possible, and found to be equal; and this was the only measure which I had of the pressure at which the gas, in the two cases, was being supplied, which would regulate the amount of gas actually consumed. The intensity of the lights was tested in Bunsen's method, by means of a greased spot on paper, placed between the two lights, and then the distance of the two lights from the paper was measured at the point at which the grease spot became almost perceptible; that is, when the two lights exactly counterbalance each other. Then, from a calculation, as the squares of the distances were to each other, so was the intensity of one light to that of the other.

I satisfied myself that on this particular morning the gas supplied by the London Company was decidedly inferior in illuminating power to that supplied by the Imperial. I should not feel sufficient confidence in these examinations, conducted in this crude manner, to say more than this, so as to say in what proportion the one gas surpassed the other.

On Saturday, I accompanied Mr. Scott to the London Company's works, Vauxhall, and there, in accordance with an appointment made by the company two or three days previously, we met the engineer, secretary, and the chemical referee of the company, Mr. Warrington. Mr. Scott will give in detail the results obtained on this occasion; we found that an Argand flame, consuming gas at the rate of 5 cubic feet per hour, gave a light equal to that of 165 sperm candles, which, if reduced to wax candles, gives about 19. Mr. Warrington gave us the result of his observations, extending over twelve months, that the average was between 14 and 16 candles; the highest about 18·5; the lowest about 12·5.

This morning, in accordance with an appointment made at three o'clock on Saturday, I met Mr. Hersey at the office of the Imperial Gas Company, York Place, New Road, where the company have a room fitted up specially for photometrical examinations.

A sperm candle was used, and weighed before and after the experiments. We found that 21 grains of the candle were consumed in the time, or at the rate of 126 grains per hour. The Argand burner of gas, with which it was compared, consumed gas at the rate of 5 cubic feet per hour.

During the ten minutes, 21 experiments were made, and the average of these gave the illuminating power at 14·419 candles, burning in the same manner as the candle used. This, reduced to the parliamentary standard of 120 grains of material consumed in the hour, gave 15·14 candles; but sperm candles give a superior light to the wax in the ratio of about 13 to 11; so this gives 11 : 13 :: 15·14 : 17·9, which is the number of wax candles to which the gas was equal.

The parliamentary standard is, that gas in an Argand burner, consumed at the rate of 5 cubic feet per hour, should give a light equal to 12 candles, consuming 120 grains in the hour.

We thus see that the gas supplied by both companies was much above the parliamentary standard; and in the two cases examined, the London gas was equal to nearly 19 candles, and the Imperial to about 18 candles; whilst, in the preliminary examination, the London was not quite so good as the Imperial.

With regard to purity, I may say that I tested both for *sulphuretted hydrogen*, and found them free from it.

In order to make a *complete analysis* of the gases, a very expensive apparatus is required, much time, and extremely delicate manipulation.

The analysis of gas can only be done satisfactorily by one who is professedly an analytical chemist, and devotes his whole time to such researches.

An examination of the illuminating power may be made by any intelligent person, provided that the apparatus necessary for the purpose be provided. In order to arrive at any satisfactory conclusion as to the relative qualities of the gases, examinations should be made almost daily for some weeks or months.

I remain, gentlemen, your obedient servant,

THOMAS HILLIER.

The CHAIRMAN asked Dr. Hillier whether, in his opinion, there was any difference in the quality of the two gases which would justify them in paying a higher price for the one more than the other?

Dr. HILLIER said, from the experiments he had made, there was nothing to warrant their paying a higher price for one over the other.

The CHAIRMAN put the same question to Mr. SCOTT, who said he quite concurred with Dr. Hillier.

The CHAIRMAN then said, having heard both reports, and the opinion of their medical officer of health and chief surveyor, that the difference in the quality of the gas of the companies did not warrant their paying a higher price for the one over the other, he wished to know the pleasure of the gentlemen present in the matter.

Mr. LAWFORD said, he should repeat the motion he made last week, which was, "That the tender of the London Company be accepted."

Dr. ELLIS said, before the committee passed any resolution, he was desirous that they should, as they were about to contract for a supply of gas, take steps to ensure that the parish should have the supply of gas they contracted for. It was a subject which had created a deal of discussion in Marylebone; and, before they entered into the contract, he should like Dr. Letheby's analysis and report, as to the quantity and illuminating power of the gas supplied to Marylebone, to be read to the committee; he (Dr. Ellis) thought it fully bore upon the terms of their contract.

The CHAIRMAN said, the terms of their contract were for bat's-wing burners, to consume not less than 5 feet of gas per hour.

Mr. LAWFORD thought there was no necessity to read the Marylebone report; as, if they contracted for a bat's-wing burner to consume 5 feet per hour, they had the power to test whether they were supplied with that quantity or not.

The CHAIRMAN said they could put up a meter to test whether they had the quantity or not that they contracted for.

Mr. CRANE said they were in this position—that they must have one of the two gas companies' gas. (Hear.)

Mr. LAWFORD thought that it was their own fault, as they contracted for a certain supply of gas, if they did not get it, and he could not see what Dr. Letherby's report had to do with the question.

Dr. ELLIS could show, if it was read, that it did bear upon the question.

The CHAIRMAN then asked Mr. Scott to read the printed report which had been furnished to the Marylebone vestry some months since by Dr. Letheby, and which stated that that gentleman was employed to test the quality as well as quantity of the gas supplied by the Imperial Company to the public lights of St. Marylebone, and that he found the illuminating power of the gas to be above the parliamentary standard; but the supply was in various places below the amount contracted for, as to the consumption of each burner—four feet per hour.

Mr. LAWFORD said the onus was thrown upon them to see that their contract was fulfilled, and it was their own fault if they did not do so. They had come to the point as to the acceptance of a tender; and, sitting there to legislate on behalf of the ratepayers, he thought they were bound to accept the lowest tender, or report that such tender ought to be accepted by the vestry. The London Company's was the lowest tender, and they had heard from their chief surveyor and officer of health, that it was superior in quality; he therefore moved that the London Company have the contract.

The Rev. R. LITTLAR seconded the motion, and said this was a most important question, as they would soon have other gas contracts falling in; he believed, most of them.

Mr. DOUGLAS said the last would be in December, 1858.

Mr. SCOTT said there was one contract which would not terminate until 1861.

Mr. LITTLAR wished to know if they should take the London Gas Company's contract for one, two, or three years?

Mr. SIMPSON thought there was one point in their advertisement which the Imperial Company objected to, and that was the repairing of the roads they break up in laying down their pipes.

Mr. ECKETT: The London Company made no objection to repair the roads.

The CHAIRMAN said, there was one point on which both companies made the same objection, and that was as to their right to change the burners.

Mr. BEARD wished to ask whether the surveyor and medical officer, in making their experiments, had turned their attention to the point so as to get out a rule to ascertain the exact value of each company's gas?

The CHAIRMAN: The reports had gone fully into that question.

Dr. ELLIS said the parliamentary standard compelled gas burned at the rate of five cubic feet per hour to give out an illuminating power equal to twelve wax candles, and that both of the companies gave a gas of nearly 20 per cent. above that standard; but that was not the question with them, any more than Marylebone. There had been a loss there, he had been informed, of nearly £3000 in one year; but it was not to the illuminating power of the gas that that loss was attributable, but to the circumstance that the parish of Marylebone did not have the four feet of gas per hour for which they paid. He (Dr. Ellis) thought it might arise from two causes; first, from the taps not being properly turned on, so as to allow the burners to consume the proper quantity of gas contracted for; and, secondly, that there might not be sufficient amount of pressure put on by the company at their works. He thought they ought to ascertain what degree of pressure could be put on the lights, so as to give the adequate supply, and that it should be done without reference to which company they accepted.

The CHAIRMAN quite agreed with Dr. Ellis, and thought they should periodically test the quality and the pressure of the gas.

Mr. OUGHTON said, another important point was, to take care that the gas should be lighted at the proper hour, and not be put out before the proper hour. (Hear.)

The CHAIRMAN said the tender was from sunset to sunrise, and was it their pleasure to accept the tender of the London Company?

Mr. ECKETT said the resolution could not be carried in that form; it must be, "That this committee recommend to the vestry to accept the contract of the London Company."

The question arose as to whether the tender should be accepted for one, two, or three years, when the Rev. R. Littlar moved, "That the contract with the London Gas Company be entered into for not less than one year." (No, no.)

Mr. ECKETT said it was most unusual to call upon a gas company to enter into a contract for one year only, more especially if they had to lay down their pipes. (Hear.)

Mr. CRANE moved that they contract for three years at once. Coals might be dearer, and they might not get the contract at such advantage as the present.

The CHAIRMAN thought that such a course as that would be inconvenient, as the gas-lighting contracts were falling in at various periods.

Mr. CHAMP thought they should make the contract for two years, as most of the contracts would fall in by that time.

Mr. ECKETT thought that the difficulty might be met by passing a resolution to the effect "That the contract with the London Company be taken for three years; but that it be terminated at the end of one, two, or three years, at the option of the vestry."

Mr. STROUD said they ought to take their gas from that company which offered them the best terms; and they might have better terms offered them than these, at the end of 12 months. He therefore moved, "That this contract be taken for 12 months."

Mr. LITTLAR seconded this motion.

The CHAIRMAN thought Mr. Eckett's suggestion the most proper and business-like way of framing the resolution; but, before they did so, he thought they had bettter see if there was any one from the London Company present.

Mr. HIND, secretary of the London Company, was then called in.

The CHAIRMAN asked Mr. Hinde if his company's tender was at the option of the vestry, for one, two, or three years, at the same price?

Mr. HINDE: Yes.

The CHAIRMAN: And would the vestry have the power of terminating the contract at the end of either the first, second, or third year?

Mr. HIND said they would; but he thought it should be for two years certain, as their company would have to put down some pipes.

After some other questions relative to the quality of the gas, and the time of lighting, &c., put by the chairman, and answered by Mr. Hinde, the resolution was put in the following form:—"That it be recommended to the vestry to accept the tender of the London Company for three years, terminable at the end of the first, second, or third year, at the option of the vestry; and that the company be requested to proceed with the lighting of Britannia Street and Haverstock Hill districts forthwith."

The resolution was carried unanimously.

The CHAIRMAN said, he begged to inform Mr. Hinde that they should take steps to test the quantity as well as quality of their gas.

Mr. HINDE said they should have no objection, as they were not a people of a day, but had served the parish 20 years. He then retired, and the proceedings of the committee terminated.

At the meeting of the vestry held on the following Thurday, Mr. Churchwarden STREETON in the chair,

The resolution of the committee of works was brought up and adopted, and the lighting ordered to be carried out forthwith.

SHEFFIELD.—By one of those re-actions so common in popular bodies, Mr. Edwin Unwin, the spirited managing director of the Sheffield United Gas Company, was, on the 10th ultimo, elected to fill the honourable office of alderman of that important borough, by a town council which has heretofore rendered itself conspicuous by the abuse it has lavished on him. Mr. Alderman Unwin has reason to be proud of this triumph of principle over a combination of unprincipled agitators and their ignorant dupes.

PRODUCTION AND COST OF GAS IN THE SOUTH OF FRANCE.—At page 128 of the "*Nouvelles Annales de Construction*," a note is inserted upon the results obtained by the company which lights the towns of Albi, Villefranche, Cette, Beaucaire, Tarascon, Toulouse, Nismes, Strasbourg, and Vaise lez Lyon. From the official returns of the company, it appears that it consumed the following quantities of raw materials in August, 1856:—

Coal distilled for the production of gas.. ..	1,012,625 kilogs.
Coke burnt under the retorts, or rather coal converted into coke for that purpose and weighed as coal	389,925 „
	1,402,550 kilogs.

In the same month, the quantity of gas produced was equal to 227,058 mètres cube, or, on the average, 22·40 mètres for every 100 kilogs. of coal, nearly 402·7 cubic feet for every cwt. The coal employed in the operations of heating and distilling produced 840,699 kilogs. of coke, a little more than 60 per cent. The tar produced was 45,565 kilogs., or about 4½ per cent. of the coal distilled. The receipts of the company were—

Lighting account	63,978·50 frs.
Coke ditto	32,655·00 „
Tar ditto	2,278·40 „
Total	98,911·90 frs.

The coal for distillation, on the other hand, cost .. .. 34,209·55 frs.
That for coke .. .. 13,072·25 „
General expenses .. .. 11,362·90 „
58,644·70 „

Profit .. .. 40,267·20 frs.

The price of the gas sold was, on the average, 28·15 centimes the mètre cube, or about 6s. 4¾d. per 1000 cubic feet.

DUBLIN.—The rejected of Sheffield, Liverpool, Bath, Bristol, &c. &c., is now entertaining the citizens of the capital of the Sister Isle with a repetition of his stereotyped fables of the frauds committed to their prejudice by the incorrect registration of their gas-meters. It remains to be seen whether the Dublin public are more gullable than their less volatile brethren on this side of St. George's Channel.

Price Current.

CASTINGS, per Ton.

Average Weight of Cast-Iron Gas-Pipes, per Yard.

1¼ in.	2 in.	2½ in.	3 in.	4 in.	5 in.	6 in.	7 in.	8 in.	9 in.	10 in.	12 in.
16	21	28	33	51	70	89	107	126	149	177	208 lbs.

Retail Prices are 5 to 10 per cent. higher.	London.	Glasgow	Newcastle.	Wales.	Yorkshire, Derbyshire, and Staffordshire.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Pig Iron, No. 1	4 10 0	3 15 0	3 15 0	4 0 0	4 0 0
1½ and 2 inches Socket Pipes . . .	8 0 0	7 5 0	7 10 0	7 15 0	7 10 0
2½ and 3 „ „ „ . . .	7 10 0	7 0 0	7 5 0	7 10 0	7 5 0
4 and 5 „ „ „ . . .	7 10 0	6 15 0	7 0 0	7 5 0	7 0 0
6 in. & upwards „ „ . . .	7 5 0	6 10 0	6 10 0	7 0 0	6 10 0
Retorts, 1st fusion, hot blast . . .	7 0 0	...	7 0 0	7 5 0	7 0 0
„ 2nd „ cold „ . . .	8 0 0	...	7 5 0	7 10 0	7 5 0
Tank Plates, ¼ thick and above . .	7 10 0	6 15 0	7 0 0	7 5 0	7 0 0

COALS.

NEWCASTLE.	s. d.		SCOTCH CANNEL.	per ton.
Unscreened.	7 0	per ton	Boghead, at Leith	38s. 0d.
Whitwell Primrose	7 6	„	Kirkness, best	23 0
Pelton and Medomsley . .	7 6	„	Capeldrae, 1st quality	20 0
Pelaw	7 9	„	„ 2nd „	12 6
Burnhope, Eighton Moor, New Pelton, Peareth, South Pelaw, Washington Hutton, and South Peareth	8 0	„	Lesmahago, at Glasgow	25 0
			„ „ Leith	27 6
			Arniston.	22 0
			Wemyss.	20 0
			Knightswood	18 0
Ramsay's Newcastle Cannel	15 0	„	Methill	13 0

SUNDRIES.

Best Newcastle fire-bricks . 60s. per 1000		Welch bar iron, in London	£8. 10 per ton.
„ „ „ clay . . 12s. per ton.		Foreign spelter	£28 „
Cliff's fire-bricks at Wortley, 57s. 6d. p. 1000		English block tin	£138 „
Tough cake copper . . £117. 10s. per ton.		Banca „ „	£140 „
English pig lead	£23 „	Tarred rope yarn	18s. per cwt.

WROUGHT-IRON TUBING, subject to 35 per cent. Discount.

	2 inches.	1½ inch.	1¼ inch.	1 inch.	¾ inch.	½ inch.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Patent welded tubes, from 2 to 12 feet, per foot	1 8	1 0	0 10	0 7	0 5	0 4½
„ „ „ 6 in. to 18 in., each	3 0	2 0	1 9	1 3	1 0	0 9
Connecting pieces, or long screws	3 6	2 3	2 0	1 6	1 2	0 11
Bends, springs, and elbows—wrought iron . .	3 9	2 3	1 9	1 0	0 10	0 8
Tees, wrought or cast.	4 0	2 6	2 0	1 6	1 1	0 10
Crosses, wrought or cast	4 6	3 0	2 6	2 0	1 6	1 2
Iron cocks	17 6	9 6	7 6	4 6	3 3	2 6
„ with brass plug	28 0	16 0	13 0	7 0	5 6	4 6
Diminishing sockets, caps, plugs, and nipples .	1 3	0 9	0 8	0 6	0 5	0 4
Plain Sockets	1 0	0 8	0 7	0 5	0 4	0 3
Syphons, 2 quart	15 0	14 0	13 6	13 0	12 0	

FREIGHTS, per Ton.

Coastwise—Newcastle.		*Foreign.*	
Chatham & Roches-	8s. 3d	Boulogne	10s. 0d
Cork . . . . . [ter	12 0	Barcelona	30 0
Dover.	8 6	Bordeaux	21 0
Dublin	12 0	Cadiz	22 0
Exeter Quay . . .	12 0	Calais	10 0
Folkestone	8 9	Dieppe	12 9
Hastings	10 0	Genoa	30 0
London. . [mouth	8 3	Hamburg	15 0
Lowestoft & Yar-	5 9	Havre	12 6
Lynn	6 9	Leghorn	24 0
Portsmouth . . .	10 0	Lisbon	23 0
Plymouth	11 6	Rotterdam	11 9
Whitstable	8 0	Stettin	12 6
Weymouth	9 6	Trieste & Venice . .	35 0

Advertisements.

VOL. IV. of the JOURNAL of GAS LIGHTING for 1855, is now ready for delivery, price 15s., bound in cloth and lettered. Cloth backs for binding, 2s. 6d. each. A few copies of Vols. II. and III. are also still on sale.
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LLOYD and SUMMERFIELD, Manufacturers of CUT and FLINT GLASS Jet Moons, Globes, Hemispheres, and Chimneys of every description; Hall Lamps, Lustres, and Chandeliers of the most modern patterns.
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KAY'S Patent Equitable Gas-Meter. The attention of Gas Companies is requested to the above Meter as an efficient preventive of fraud by "tilting," so often resorted to by dishonest consumers.
Manufactured only by WM. COWAN, 60, Buccleugh Street, EDINBURGH.

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GARSIDE'S IMPROVED MAIN-DRILLING CLIPS, for Drilling Holes for Service-Pipes. With this Instrument the perforation of pipes for the attachment of smaller Tubes can be effected with great ease and precision. Likewise,
HEAP'S REGISTERED GAS TONGS, most highly approved of as vastly superior to those in present use.
For Drawings, Testimonials, and Prices, apply to Mr. G. JAQUES, 3, Gloucester Road North, REGENT'S PARK, Sole Agent in London; or to the Maker, S. GARSIDE, Stamford Street, ASHTON-UNDER-LYNE.

NOTICE.—INFRINGEMENT OF PATENT.

CRICKMER'S Patent Metallic Packing for Steam-Engines, Pistons, Piston-Rod Stuffing-Boxes, Pumps, &c.—Notice is hereby given that a perpetual Injunction of the High Court of Chancery has been obtained by Messrs. OASTLER and PALMER, trading under the Firm of ALEX. ROSS and CO., Grange Mills, Bermondsey, against Messrs. LITTLE and CHAMBERS, of Manchester, to restrain them from further infringing the above Patent; and that the above Packing can only be obtained of Messrs. ALEX. ROSS and CO., Grange Mills, Bermondsey, LONDON (the Proprietors of the Patent), or by their authorised Agents.
MILL BANDS, HOSE PIPES, & FIRE BUCKETS made to order from the best-selected Oak-Bark Tanned Leather.
Prices Current to be had on application.

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The Bank of England is fitted entirely with these Valves, from the smallest branch to the largest main pipe.
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"Gentlemen,—In reply to your inquiry, I have to state that 'Carter's Patent Gas Valve' has been used by this company and by the fitters of the district extensively for seven years past. It was adopted to obviate the inconvenience of setting fast, so prevalent with the conical metal plug-cocks, and has been found to answer the purpose intended.

"I have recommended its use in several provincial towns with which I am professionally connected, and have not received any complaint of its having failed in any respect of performing satisfactorily all that is required of it.—I am, gentlemen, yours respectfully,
"GEDDIE PEARSE.

"Messrs. Lambert and Son, Lambeth."

PATENT GAS METER MANUFACTORY, No. 66, Snow-hill, London.

WILLIAM SMITH, by the improvements he has made in the Wet Meter, and which he has secured by her Majesty's Royal Letters Patent, the accuracy of their registry is rendered certain by the introduction of the adjusting slide and hydraulic, whereby a Perfect Water Level is readily obtained, and the Hydraulic precludes the possibility of abstracting water from the meter by increased pressure or otherwise, thus surmounting the great desideratum of the Wet Meter. In his Patent Equitable Gas Meter neatness and strength are combined, the backs and fronts of the case being stamped by powerful machinery out of thick plate iron (tinned or galvanized); and the internal construction is of the best metal, which will resist the action of any impurity in the gas.
Old Meters may readily have the adjusting slide and hydraulic applied, thereby having accurate measurement assured.
Station Meters, Governors, &c., made on the shortest notice.

JUDKIN'S Improved Gas Regulator has the following advantages to recommend it to the consideration of all gas consumers:—1. It can be easily adjusted to supply gas at any required pressure below that of the street. 2. When once adjusted, it will admit of no variation in lights burning, whether they are few or many, whatever the fluctuation of pressure may be. 3. The light being purer by perfect combustion, the atmosphere is more healthy and agreeable. 4. A saving of at least from 25 to 35 per cent. in the consumption of gas is obtained. Its advantages over any other regulator are as follows:—1. It is more simple in its construction. 2. It is more sensitive in its operation, having less friction, as it works only on two steel centres, which are immersed in quicksilver. 3. It is not liable to get out of repair, and requires less attention than a meter itself. N.B.—A Testing Apparatus has been fitted up on the premises of the patentee, 33 and 35, Corporation Street, MANCHESTER; and 98, Fleet Street, LONDON, for the purpose of demonstrating the above facts.

MR. HENRY GORE,
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GAS-METER MANUFACTURERS, &c.
UNION-STREET, OLDHAM.

Station and Experimental Meters, Gas Pressure Registers, Gauges, Experimental Gasholders, Governors, Slide Valves, &c. &c.

W. and G. would respectfully call the attention of Gas Engineers and Managers to their Station-meters, having made and erected the largest in use at the present time, two of which may be seen at the Stockport and Liverpool Gas Works, on application to the respective Engineers.

JAMES FEATHERSTONE,
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Manufacturer of GASHOLDERS, IRON ROOFS, and every description of Gas Apparatus.
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(Established 1830),

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Manufactory for every description of Casting and Machinery for Gas Works and Water Works.

Warehouse in London for Cast-iron Pipes and Connections of all sizes and in any quantity, Scott's Wharf, Bankside, Southwark.

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GAS METER MANUFACTURER,
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ISLINGTON, LONDON.

Begs respectfully to announce to Gas Companies and Fitters, that from upwards of 20 years' practical experience, he is enabled to supply a METER combining correctness, durability, and economy.
N.B.—Repairs on the lowest scale.

NOTICE.—Mr. N. DEFRIES, Consulting GAS ENGINEER, begs to inform gas companies and the public, that he is desirous of meeting any gentlemen at his WORKS, NEW ROAD, ST. PANCRAS, where, under his own superindence of the manufacturing department, they will have the fullest opportunity of investigating the many improvements he has recently effected in his ROTARY-VALVE DRY GAS-METER, by which full security will be afforded against leakage and non-registration, even against the searching effects of Cannel Coal Gas. The Rotary-Valve Meter is warranted to register inflexibly correct at a working pressure of half a tenth, and less than a quarter of a foot per hour upon a blue light; and a guarantee will be given to all gas companies to keep it in repair for not less than five years, free of expense. With this meter the gas-supplier may fully depend upon a fair return, and the public upon having a just measurer.

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Gas-works erected for private houses, where no gas company exists.

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A single copy of either of the above-mentioned books will be sent, on application to the Author ONLY, by payment of the postage (1d.).

These little books are written in a simple and familiar style; showing the comfort, convenience, safety, and economy of Gas. They are intended for gratuitous distribution by Gas Companies. They have already done good service, and the author is anxious still further to extend their usefulness.

The present high prices of tallow and oil are favourable to a more general adoption of gas in private houses. Let its advantages, as yielding a pure, cheap, and healthful light, be properly explained, and there will be no difficulty in getting over a few old-fashioned prejudices. Those persons who have experienced the benfits of gas-light never go back to candles or lamps.
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ARTIFICIAL Hydraulic or Portland CEMENT, for Brickwork, Concrete, Plastering, &c., combines the valuable qualities of the natural Cements, with the additional advantage that it greatly excels them in its cementitious properties; that it is not affected by frost, and does not vegetate in damp situations. Account of COMPARATIVE EXPERIMENTS on the strength of this and other Cements (read at the Institute of Civil Engineers) to be obtained from the Makers, JOHN BAZLEY WHITE and BROTHERS, Millbank Street, WESTMINSTER, who prepare one quality only of Portland Cement.

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Are supplied to Gas Companies and the Public as the best and simplest Dry Gas Meters in use. They are acknowledged to be of first-rate workmanship and accuracy of registration.—Shears and Sons continue to supply these Meters on the most favourable terms; and they also manufacture Wet Gas Meters, to which they apply their Patent Indices.
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Manufacturers of WET and DRY GAS METERS, STATION METERS, GOVERNORS, EXPERIMENTAL APPARATUS, GAS STOVES, and LANTERNS.

Contractors for the erection or alteration of Gas Works; and every description of Apparatus required in Gas Works supplied.

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WILLINGTON QUAY,
NEAR NEWCASTLE-UPON-TYNE,
Manufacturer of Clay Retorts, Fire Bricks, and every description of Fire Clay Goods.

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GLOBE PATENT TUBE WORKS,
WEDNESBURY,

Beg to draw the attention of Engineers and Managers of Gas Works to the superior quality of the Article they manufacture, both in respect of the iron employed, and the perfect manner in which it is welded; in proof of which they can refer to the testimonials of the most eminent Gas Engineers, and the experience of the principal of the large Gas Companies of the kingdom.
Orders promptly executed.

WHITWELL PRIMROSE GAS COAL.—These excellent Gas Coals can be shipped either at the South Dock, SUNDERLAND; or Old Harbour, HARTLEPOOL; or Brandling Drops, SOUTH SHIELDS; on application to the WHITWELL COAL COMPANY, Sunderland.

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WENLOCK IRON WORKS,
WHARF ROAD, CITY ROAD, LONDON.

Mr. PENNY begs to inform Gas and Water Companies that he undertakes the erection of new, or the alteration of existing, works; and that he may be consulted generally on all matters connected with gas and water supply. He is also prepared to supply best Cold-blast Retorts, Socket-Pipes, and Connections, Iron Borings, &c. &c., and all the necessary Castings used in Gas and Water-Works.
*** Country orders executed with care and despatch.

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GAS EXPLOSIONS PREVENTED by using the Tubes and Fittings Manufactured by
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Gas Companies, Engineers, Gas Fitters, and the Trade generally, are respectfully informed this Tubing is now manufactured to any size, from ¼ inch bore and upwards, in 100-feet lengths, and perfectly cylindrical, either with or without a spiral wire inside.

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PIPES and VALVES, for Gas and Water, from 2 inches to 48 inches bore.

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JOHN VICKARY

begs to call the attention of the above to his improved METALLIC CASE GAS-METER, an improvement which has met with entire approbation from the various Gas Companies and Engineers to whom he has introduced it, and acknowledged to be the greatest improvement that has been made since the year 1833; at which period a metal was introduced for the construction of the Drum, Syphon, and Float, capable of resisting any impurities arising from either gas or water, which has been found to answer every expectation; as, in repair, Drums of the above date are found in perfect and good condition, when the Outer Case, Valve-box, Inlet-pipe, &c., are quite destroyed and entirely past repair.

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J. V. feels confident that the above will be found a most desirable and perfect instrument, as it contains all other improvements of utility that have been introduced up to the present time.

The most strict attention is given to the workmanship as well as the registration of every Meter, to render them perfectly accurate.

Station Meters, Governors, &c., made on the shortest notice, as well as Gas Cooking Apparatus of every description, Gas Baths, &c.

Meters sent at the lowest London prices.

Carriage paid to any part of England.

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GAS ENGINEERS & BRASSFOUNDERS,

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IN GLASS, ORMOLU, & BRONZE.

OUTSIDE SHOP LANTERNS,

Lined with Patent Silvered Glass.

Wrought Iron, Composition, and Tin Tube,

WITH EVERY DESCRIPTION OF

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ALWAYS IN STOCK.

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IN EVERY VARIETY, WHOLESALE AND FOR EXPORTATION.

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Pattern Books of Chandeliers, and also of all kinds of Gas Glasses, sent to any part of the Kingdom on application.

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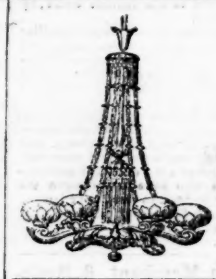

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Manufactory—Broad-street, Birmingham,

MANUFACTURERS OF GLASS CHANDELIERS, GLASS LUSTRES, TABLE GLASS, &c. &c.

ELEGANT CRYSTAL GLASS CHANDELIERS, FOR GAS

(Made from "REGISTERED" DESIGNS), with GLASS BRANCHES, &c.; suitable for DRAWING-ROOMS and BALL-ROOMS. The more extensive use of GAS in private dwellings has induced Messrs. OSLER to direct their particular attention to the manufacture of this class of articles—which, with a view to their general adoption, are offered at very moderate prices. Purchasers can select from a great variety of patterns, to which additions are being constantly made.

THEATRES, CONCERT, ASSEMBLY, AND BALL ROOMS LIGHTED BY ESTIMATE ON THE LOWEST TERMS.

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(*Successors to the late Samuel Crosley*),

COTTAGE LANE, CITY ROAD, LONDON,

Beg to announce that, in addition to the manufacture of GAS-METERS, they continue the manufacture of METERS for MEASURING WATER, SPIRITS, &c., commenced, under Patent in 1849, by the late Mr. William Parkinson.

These Meters are as simple and durable as the Gas-Meter, and as correct as that instrument in the registration of the fluids passing through them.

NO CHIMNEY WANTED FOR

RICKETS'S PATENT CALORIFERE GAS STOVES,

IN CHURCHES, HALLS, OR SHOPS;

And for Conservatories, or any close apartment, a pipe can be attached to convey away the burnt air.

RICKETS'S CHEAP GAS STOVE,

Price £1. 15s.,

Made of sheet-iron, suitable for heating small Counting-houses, Bed-rooms, Cellars, &c.

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AGAR STREET, STRAND, LONDON.

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London: Printed by THOMAS GREAVES BARLOW, of 3, Parliament Street, in the parish of St. Margaret, Westminster (at the office of Joseph Clayton, 10, Crane Court, Fleet Street); and published by WILLIAM BOUGHTON KING, of No. 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, Dec. 9, 1856.